February 1983 Volume 1 $2.00

softalk

for the IBM Personal Computer

Cupid's Computer

Exec IUS

Winning at Wizardry

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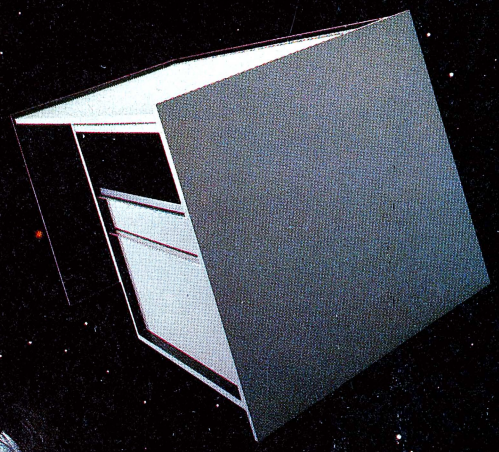

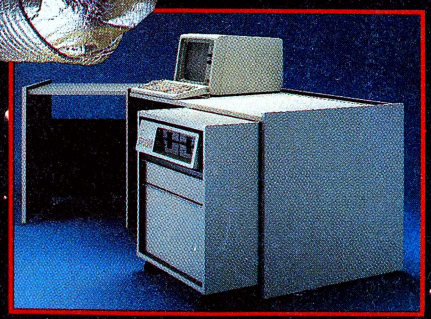

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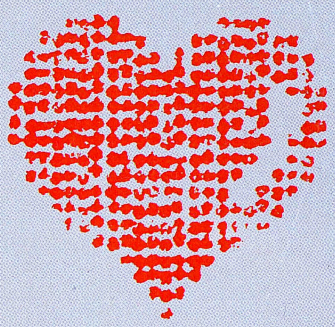
Find the ♥ bugs, or, I ♥ a contest . . .

Dear ♥ ,

I'm glad to hear you ♥ your pc as much as we ♥ ours here at *Softalk*. Our new program editor is so in ♥ with his machine that he created a word processing program that prints a ♥ every time you want to print the word ♥ . See how well it works?

We ♥ the look of ♥ throughout the issue, especially since this is the month of ♥ and Saint Valentine's Day, so we typeset the entire issue using the new ♥ program.



Unfortunately, there are still a few bugs in it. For example, if you hold down the ♥ key too long you get

♥♥♥♥♥♥♥♥♥♥♥♥♥♥♥♥♥♥♥♥♥♥♥♥♥♥♥♥♥♥

And if you hit the control key at the same time

♥♥♥♥♥♥♥♥♥♥♥♥♥♥♥♥♥♥♥♥♥♥♥♥♥♥♥♥♥♥
♥♥♥♥♥♥♥♥♥♥♥♥♥♥♥♥♥♥♥♥♥♥♥♥♥♥♥♥♥♥
♥♥♥♥ Well, you can see it gets a little out of hand. ♥ being what it is, we went ahead and used the ♥ maker anyway, and tried to catch as many ♥ bugs as we could.

Of course, under the pressure of a deadline, we couldn't catch them all. So if you can count all the ♥ bugs that got left in this issue, we'll give you $100 worth of stuff for your pc. It's a contest. We know you'll ♥ that.

Mail your total number of bugs to: ♥ , Softalk Hearts, Box 60, North Hollywood, CA 91603. Deadline is March 15, 1983. Ties will be broken by our random number generator.

For an extra $25 in goodies, please find all the times we missed the word L-O-V-E (I don't dare say it or you know what happens). You can count wherever the word appears in the text of the magazine (not including ads), whether it is by itself or part of another word. Don't count its appearance on this page.

♥ The Contest Editor

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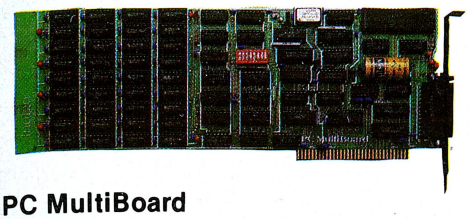

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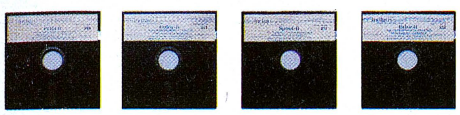

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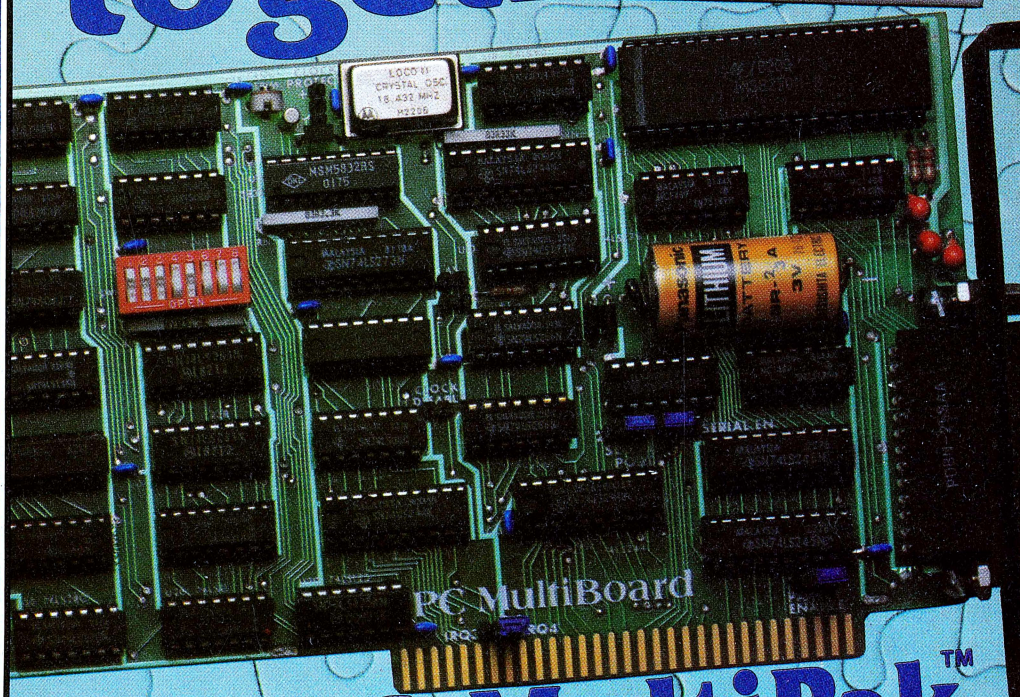

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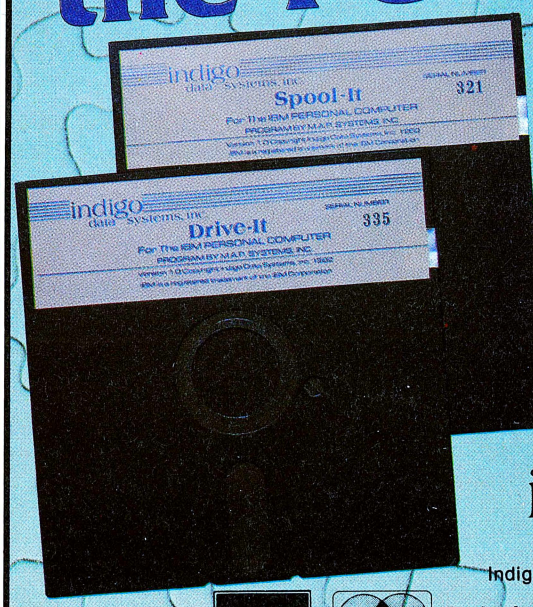

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crosstalk

Life Reviews Reviewed

Thank you for the objective and well written review in December '82 Marketalk Reviews of *Microcosm*, our strategy game for the IBM pc based on the classic game of life. Though I have not had the opportunity to see *Life* from Olive Branch Software which was reviewed concurrently with *Microcosm*, I think I can speak for both organizations in expressing our appreciation.

There were a few comments in the review that I feel merit clarification. The reviewer states, "Unfortunately, the program continually goes to disk to fetch this routine and that." I suspect the reviewer had the impression of excessive disk use because he was thoroughly testing *Microcosm*'s extensive utility options. In normal play *Microcosm* does not go to disk once the game commences.

Secondly, the reviewer gives a somewhat left-handed compliment when he credits *Microcosm* with an outstanding pattern library, "though flawed" by improperly keyed-in patterns. I am unaware of any flaws in the fifty built-in patterns, and such errors have not been reported by any users in our extensive user survey. I would have preferred it if he had been more specific regarding the flaws. If they do exist, I want to correct them and contact current owners with the information.

Two other shortcomings mentioned in the review were well taken. We will remedy them both in version 3.0 of *Microcosm* which will be available in mid January (free to current owners). First, *Microcosm*'s speed in displaying successive generations has been increased fifteenfold. Second, an optional short cut from booting to playing the game has been added, eliminating most of the keystrokes necessary for pregame setup.

Again, thank you; we wish *Softalk for the IBM Personal Computer* continued success.

Pete Weaver, president, Aeon Concepts, Pittsburgh, PA

The flaws we detected in the Microcosm *library were these: (1) the fuses were not properly anchored, (2) the harvester was miskeyed, and (3) the viruses were mislabelled.*

Copy Question

I was much intrigued by the command *copyver.bat* that Alan Boyd suggested should be in everyone's library in his column System Notebook (November 82). I've tried it and found it fascinating, but I've also discovered a problem stemming from that fact that *copy* is an internal command but *comp* isn't. As a result, I must remove the source file from drive A in order to put DOS back in, then load *comp*, trade disks, and finally compare. It might have been easier, but not as much fun, to do without *copyver.bat* altogether. The only other alternative I've found is to copy *comp* onto the source disk along with *copyver.bat* even though it may be used only once.

Is there a better way—or at least one a bit more elegant?

Roy M. Menninger, Topeka, KS

Tape Tip

Readers might be interested in the fact that the Radio Shack computer-to-cassette interface cord is an exact mate for the pc. Although I have two double-sided disk drives I still find use for cassette storage.

H. Gale Henley, Winston-Salem, NC

Crosstalk Commentary

As a heavy and happy user of the IBM pc, I keep track of many magazines dealing with this system. Although *Softalk for the IBM Personal Computer* is the most compact of them all, I feel that it is the best and the most useful. System Notebook as well as Boards and Buses greatly help in elucidating some arcane features of the pc. I would, however, like to suggest that user contributions along with the corresponding feedback would be a useful feature.

Do B. Phuoc, Hayward, CA

We agree, and we'd like to invite readers who have tips, brief programs, or any other form of intelligence that could make life easier for other pc users, to contribute same for publication in Crosstalk. This column is your space—your chance to communicate with your fellow reader. ♥

p-System Plaint

With regard to SofTech Microsystems I would like to set the record straight. SofTech will not sell directly in the IBM format any of their products. Therefore, while SofTech claims great portability and transferability across machines, they do not support even the machines they advertise. The proof of the pudding is that you cannot buy from SofTech any of their software that you can directly use on the IBM pc.

Chester M. Smith, Jr.,
University Park, PA

SofTech Replies ♥

Mr. Smith's statement that SofTech Microsystems does not directly market the p-System for the IBM pc is correct. He is incor-

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A fond farewell...

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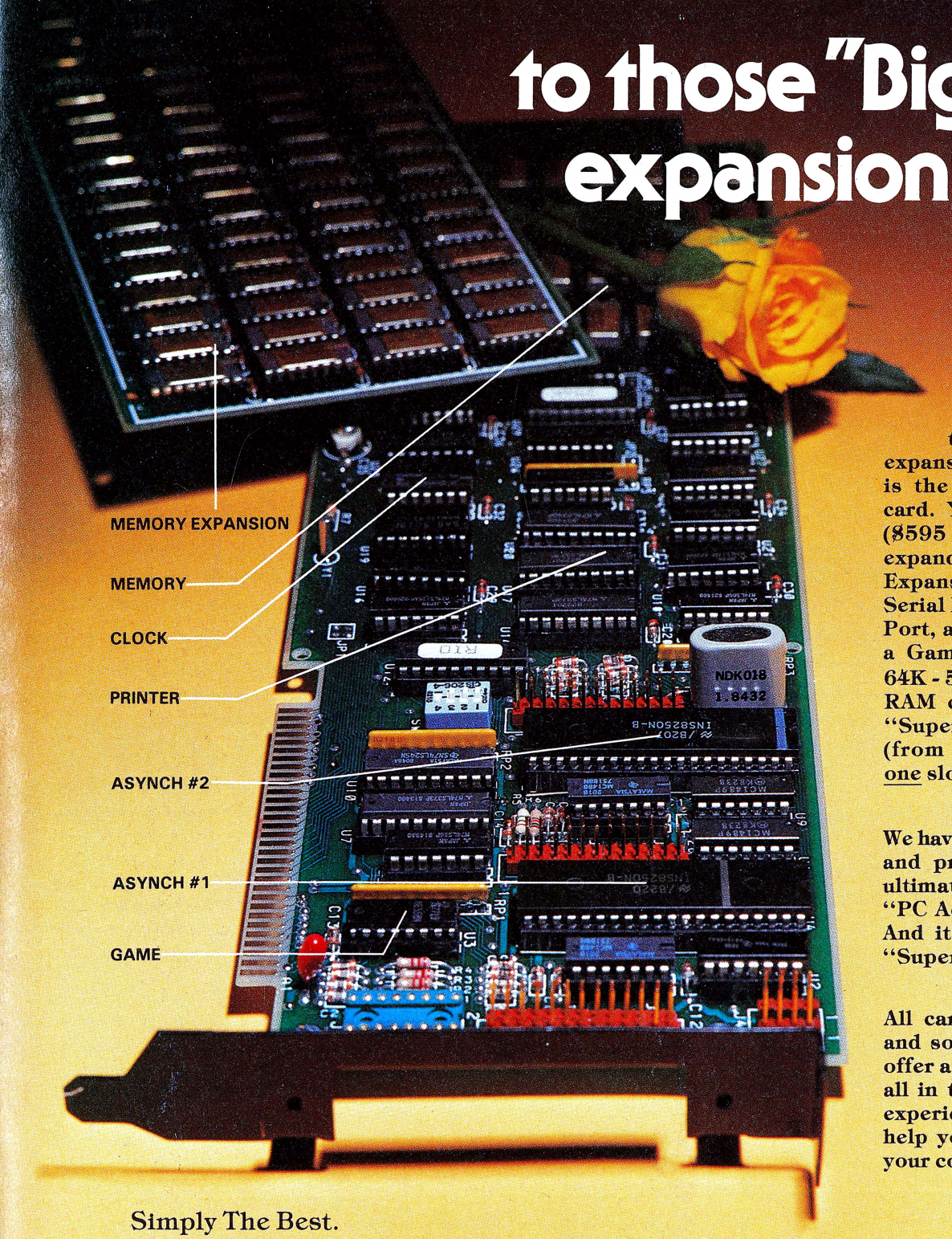

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rect, however, in his assumtion that this fact minimizes our portability claims. On the contrary, our advertising is accurate in this regard and we can support our claims to "universality" or transportability. It is important to understand that our "claim" is to object code portability and, regretably, software cannot ameliorate all electronic incompatibilities such as disk size and format differences.

Mr. Smith's misunderstanding may stem from a misconception about how we market our products. I believe that he, as well as other readers, might benefit from a brief description of one of our major marketing strategies.

Currently SoftTech Microsystems's primary p-System sales are through OEMs. Most manufacturers license the system through us and then market it preconfigured for their hardware. These OEM sales represent a significant part of our revenues, so it should be understandable that we have chosen not to set ourselves up in direct competition with our licensees by also selling the p-System for their hardware. This is not unusual, by the way. Neither Microsoft nor Digital Research sells its operating system directly for the IBM pc.

This situation does not minimize our portability claims; it simply allows us to broaden our base of p-System machines more rapidly and efficiently than would be possible if we marketed all p-Systems directly. With this approach we are able to utilize the vast resources of major forces in the marketplace, such as IBM, in marketing the p-System. This broad p-System base then translates to benefits for applications developers by allowing them to market their product across a wider variety of hardware.

I sincerely hope that I have cleared up some of the confusion, and I invite Mr. Smith to contact me directly should he have any further questions.

Maura Smith, director of communications, SofTech Microsystems,
San Diego, CA

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BPI Defends Product

We tried to contact Thomas Reifsnyder to clarify some issues he raised in his letter that appeared in December '82 Crosstalk criticizing BPI's *General Accounting System*. In the absence of a dialogue with Mr. Reifsnyder we wish to offer the following comments.

His statement that the lines in Basic exceeding 255 don't work is incorrect. They do work. His claim that the profit and loss statement puts out only a one-line item for income statements seems confusing. If he wants to show several line items for gross sales and then a sum, the system will permit this easily. He also has the option to show one line item for gross sales and then several line items at the end of the profit and loss statement for other kinds of income. Furthermore, it's possible to produce up to eleven departmental profit and loss statements and one that shows a consolidated profit and loss. The user has a great deal of flexibility in this regard.

Regarding the changing of headings, in the profit and loss statement and balance sheet they are completely under the user's control. However, subtotals are titled "totals" and this cannot be changed by the user.

We object strongly to Mr. Reifsnyder's comment that our product is unacceptable to accountants and that it was rushed to market. Our product was designed by accountants and subjected to the greatest scrutiny by CPAs for accounting correctness. There are more than thirty thousand BPI *General Accounting Systems* in use by the most severe critics of any product, the end user. We have files and files of letters praising this product from happy end users. We never rush a product to market. Haste makes waste in this quality-sensitive marketplace, and this is contrary to our basic business philosophy.

The observation that we are concerned about piracy and that our software is encrypted is correct. If Mr. Reifsnyder or other users would like help in using our product they should feel free to contact me at (512) 454-7191.

Robert C. Orr, BPI Systems sales manager, Austin, TX ▲

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*The Home Accountant™ is available for the Apple II/IBM Personal Computer/Atari 400/800 Computers/Osborne/TRS 80 Model III/Commodore VIC 64. The actual budget capacities will vary with each computer.

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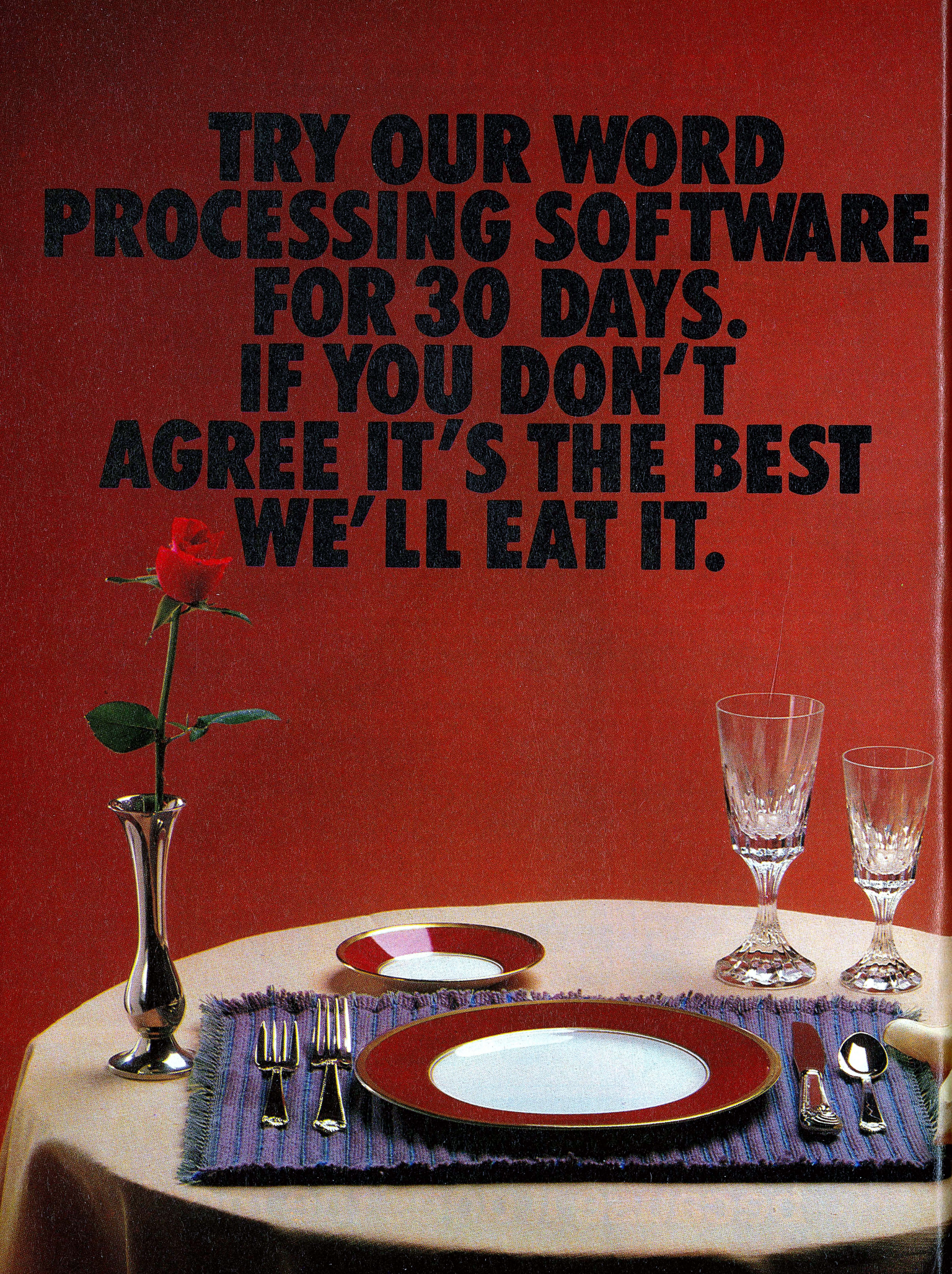

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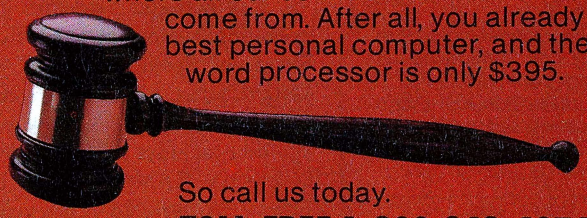

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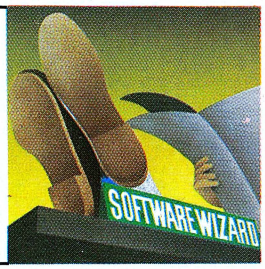

Δ Price allowances to qualifying educational institutions have been announced by **IBM** (Boca Raton, FL). To qualify for the hardware and software discounts, public or nonprofit schools—including parochial and independent schools, colleges, universities, and vocational and technical schools—must be recognized and accredited by their state boards of education or other appropriate agency. The price allowances vary according to system configurations.

Δ **Corona Data Systems** (Westlake Village, CA) has signed agreements with eleven regional stocking distributors for over $12 million in hard disk subsystems, according to company president, **Daniel Carter**. The eleven companies are the foundation of Corona's hard disk distribution and of Corona's personal business computer.

The distributors named (and their regions of heaviest support) are: Victor Electronics (New England area), F.A. Components (metropolitan New York), Jersey Micro Systems (the mid-Atlantic area), Computermaxx (southeastern region), Kaltronics Distributors (north central region), High Technology (central region), Acorn Data Products (mountain and western states), Sigma Distributing (northwest), Waybern (southern California), Vitek (also southern California), and Datamex (Canada).

Corona has opened Eastern and Western regional offices to support the distribution network and is currently hiring for its midwestern office. Sales training programs are also in full swing—"to reduce the amount of time it takes dealers to learn to sell our products," says Carter.

Δ A joint business arrangement to distribute a Winchester hard disk and concurrent operating system is announced by **Digital Research** (Pacific Grove, CA) and **Percom Data** (Dallas, TX). The two companies have agreed to produce PC Power Pack, a package that includes a Percom Winchester hard disk drive, RAM board and controller, and Digital Research's Concurrent CP/M-86 operating system. Percom Data will market the package.

Δ **Caren Kelman** has been appointed manager of Independent Software Vendors at Digital Research. The position was created to reinforce the company's commitment to a strong partnership with vendors. A cooperative advertising program that will run ads in major business and vertical market publications has begun. "The advertising is leverage," says Kelman. "We'll all gain exposure in high-priced, high-visibility publications such as *Business Week*." Digital Research is picking up the tab for administration and production costs of the campaign.

Δ "The first entrance of a major Fortune 500 company into the microcomputer software industry" is how **Bill Webster**, president of **Star Computer Systems** (Torrance, CA), describes his company's agreement to let **Control Data Capital** buy 21 percent of Star's capital stock. Control Data Capital (CDC) has also placed a quarter million dollar order for software. Star software will also be distributed in CDC's nearly one hundred business centers throughout the country.

Δ **Micro Peripherals** (Salt Lake City, UT) announces the addition of five telemarketing people to its sales force. **Jamie Johnson**, director of sales, says the company intends to establish a strong foothold in the very competitive printer marketplace. The five newcomers join Johnson's telephone staff, trained in operations and service of MPI's dot matrix printer as well as in phone marketing.

Δ One million dollars in venture capital has been placed in **Epyx/Automated Simulations** (Sunnyvale, CA) by two firms, **The Early Stage Partnership** and **U.S. Ventures.** Additional financing to reposition the company in the marketplace has been obtained from Bank of the West.

Δ The **Computerland** chain of more than 300 sales outlets is a new outlet for **Alpha Software** (Burlington, MA). After testing the products at seven locations, Computerland approved distribution of the company's line of business and professional software. "Retailers get excited about software that helps sell hardware," says Richard Rabins, Alpha director of sales. Alpha products are also available at seventy-five independent computer specialty stores.

Δ **Howard W. Sams & Company** (Indianapolis, IN) announces the four winners of their national '82 Microcomputer Sweepstakes. First prize is a Commodore VIC 20. (What? Not a pc?)

Δ The publisher of *InfoWorld*, **CW Communications** (San Francisco, CA), is starting a new magazine called *PC World*. Plans to set up a state-of-the-art office network and build a super pc with "thousands of peripherals and hundreds of capabilities" were announced by editor-in-chief **David Bunnell**. Bunnell had previously started up *Personal Computing* and *PC* magazines. ▲

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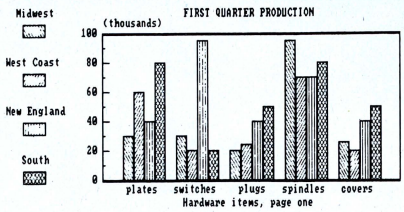

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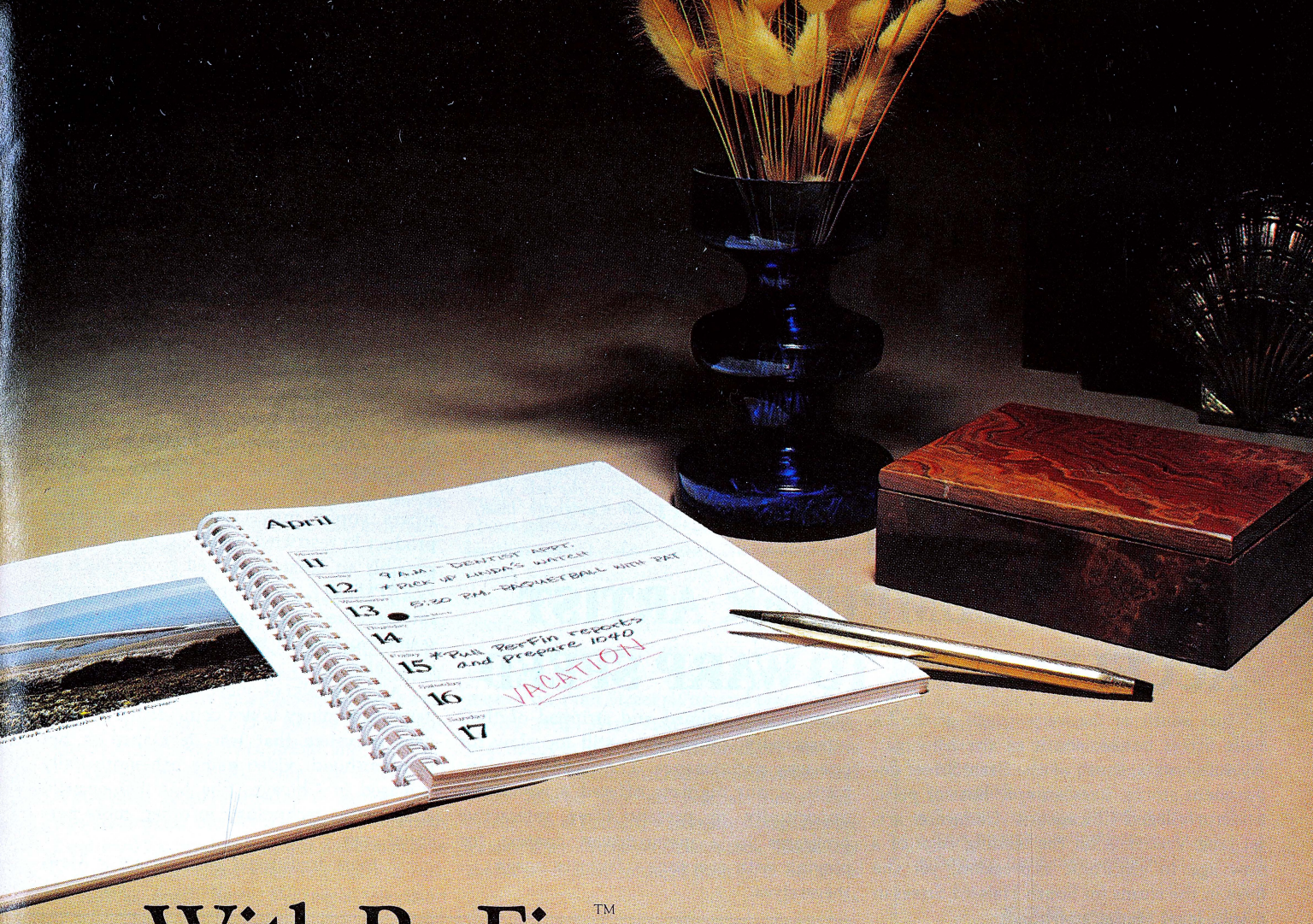

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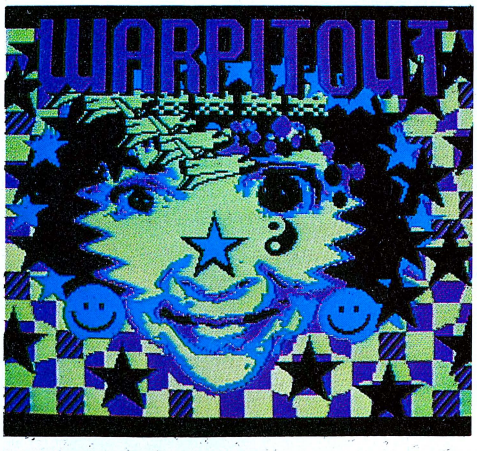
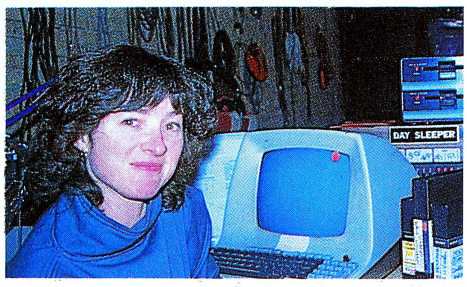




The background picture is from WARPITOUT—*Veeder's own face jazzed up with the help of ZGRASS, an advanced graphics language. Inset, Veeder and her tools.*

CHICAGO COMPUTER ARTIST ACCELERATES TO WARP SPEED

Just south of the loop, south of the La Salle Street banks, south of the Michigan Avenue hotels, south of the State Street department stores, lives an epic host of poor, underprivileged Chicagoans. Computer artist Jane Veeder is on the leading edge of a new age in electronic expression, yet she lives in the slums on South Halsted Street in a split-level studio apartment.

In that apartment, Veeder and her fellow artist Phil Morton have an impressive array of computer gadgetry, including a Datamax UV-1 Graphics Computer, a Sandin Image Processor, and assorted video equipment. CRT buses shake the building when they roar up Halsted just outside the front door, but they have little effect on the concentration of Veeder and Morton.

Veeder's latest creation, *WARPITOUT*, made an impressive debut at the SIGGRAPH '82 Art Show in Boston this summer. Held annually for the last nine years by the Association for Computing Machinery's Special Interest Group on Computer Graphics, SIGGRAPH is the Academy Awards for computer artists.

In Veeder's own words, *WARPITOUT* is an "interactive computer graphics installation, supporting real-time color graphic processing of a digitized (facial) image of the current player using a menu-driven selection of drawing and processing programs, housed in a video-game cabinet."

Veeder's manifesto further explains the genesis of this computer game cum computer art program: "I had developed a number of generalized real-time computer graphics process program tools that I loved to play with. Some I had adapted into animation sequences, streamlined and stripped of their interactivity; others were still too slow for one-way performance. The recent development of our digitizer offered a wonderful opportunity to present these interactive programs in a menu-driven context for playing with everyone's favorite image . . . themselves."

Burned into eprom and housed in a video-game cabinet, *WARPITOUT* allows the user/player to be Lon Chaney, Salvadore Dali, and Vincent Van Gogh with a digitized image of your own face. It was a big hit at SIGGRAPH, but it raised many questions as to its status as a true work of art.

"Is it art? That's the first question. Let's go on to the next one," Veeder offers. How about an artistic video game? "With *WARPITOUT*, I'm using the universal appeal of your own face as a pretext to indulge in computer graphics more directly than you get to do with a commercial video game, where you're interacting with a finished product in restricted ways. ZGRASS makes possible an artist-integrated project such as *WARPITOUT*, as contrasted to the corporate-designed videogames accomplished by teams working in fragmentary and specialized roles."

All this talk of video games and video game technology is not coincidental. Veeder uses a system that was developed in her neighborhood; video game behemoth Bally is based in Chicago. She has just smartly adapted the technology to other, more personal uses.

A more traditional work of art is *Mon-*

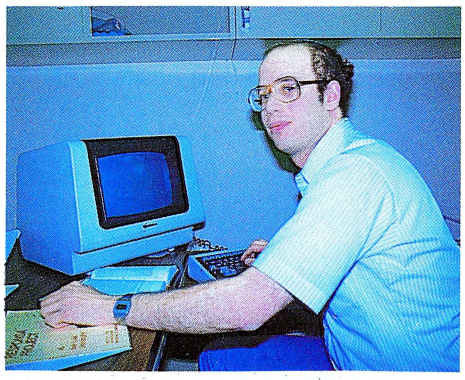
GOTO 16

Jewish Institute Imparts Religious Law With Computers

It should come as no surprise that technology is becoming the handmaiden of religion. The same computers that form the brains of multimillion-dollar corporations and lord it over scientific research institutes are being harnessed for the never-ending task of analyzing religious history and law.

One of the most ambitious projects involving computers and religious study was started in 1968 at Bar-Ilan University in Israel. A decade later, close to two hundred volumes of Halachic Responsa (the writings of ordained rabbis) dating from the eighth century to the present were assembled on a database using a large mainframe computer.

A little over a year ago the Institute for Computers in Jewish Life, based in Chicago, became the North American Center for the Bar-Ilan University Responsa Project. A copy of the database in Israel was put on an IBM 370/168 and a terminal was set up in the offices of the Institute at Chicago's Water Tower Place.



Rabbi Allan Rosenbaum seated before the terminal by which he accesses the Responsa database—a space-age tool for investigating age-old problems.

Using a TeleVideo terminal with a Hebrew text chip, Rabbi Irving Rosenbaum and his son Rabbi Allan Rosenbaum gain access to the Responsa database to perform complicated search routines, and print out the re-

WARNERS REELS FROM ATARI'S UNEXPECTED DROP IN PROFITS

Pity the poor investor. Practically nothing's a blue chip stock these days. Especially not if the company dabbles in the VCS game market. And especially not if the company is Warner Communications.

Warner Communications, for those of you who missed Bugs Bunny and Errol Flynn, once was Warner Brothers Studio.

Filmmakers fell on hard times in the late sixties and early seventies, and Warner fell right along with the rest of them. It seems that folks just couldn't be motivated to go out to a movie. Out went old management and in came new, in the person of Steven Ross, still fearless leader of the entertainment conglomerate.

Ross took the remainder of Warner's dwindling assets and diversified the company—as indicated by its present name. He took Warner into cable television; their QUBE system, pioneered in Columbus, Ohio, remains the most advanced cable system in the country. But where Ross really struck it rich was in celluloid and silicon.

Dating essentially from the release of *Star Wars,* people returned to movie theaters in droves. *Star Wars* was a Twentieth Century-Fox production, but *Superman* was a superhit that filled Warner's coffers with almost as much lucre. Warner's television production division was also on a roll during that period.

This turnaround in entertainment fortunes was most fortuitous because Ross had his eye on a company called Atari. Nolan Bushnell's firm had Magnavox's Odyssey system on the run, but the mid-seventies were not a good time for a young company to look to the stock market for expansion financing. So, for $28 million, Warner picked up the promising gamemaker.

The stock market was not exactly buoyed by the news. What the devil did a bunch of prima donna movie people know about games anyway? Perhaps nothing, but by that time it didn't matter. In its first year under the Warner umbrella and with the financial help of the parent, Atari reported profits—not sales, mind you, but profits—of $25 million, nearly recouping Warner's investment in one year and making the smart money on Wall Street sit up and take notice.

By 1981, Atari had sales of $1 billion, practically a monopolistic hold on the low end of the home entertainment market and what looked like an eternal money-machine. Oh my, did the investors buy. In five years, they drove Warner stock from less than five dollars to more than fifty dollars a

GOTO 14

sults on a Decwriter IV also equipped with a Hebrew text chip.

According to the younger Rosenbaum, the Responsa Project provides very sophisticated search programs that go beyond the mundane and the everyday. For instance, you can search for the accumulated responses to the question: "When, according to Jewish Law, is the exact moment of death?" Or: "May an orthodox Jewish doctor send a patient to another physician to administer treatment which he himself may not perform because it is forbidden according to Jewish Law?"

Jewish scholars have benefited greatly from the Responsa Project, but it's not limited just to religious and ethical problems. Due to the vast amount of data stored, which covers a myriad of subjects, it's possible to glean information, for instance, about interest rates charged by European merchant bankers for the fourteenth through sixteenth centuries. Both Rosenbaums are encouraging regular scholars and historians to use the Responsa Project for their nonreligious research.

When people wish to perform searches, they must first fill out a comprehensive "search profile." The desired results are broken down into "an exact formulation of the search topic." You can have the whole database searched or just specific works, which you must indicate in the original Hebrew. Ultimately, the process is narrowed down to key words and key phrases.

"The scope of Jewish Law is so vast," explains Rabbi Allan Rosenbaum, "that performing a search for a subject like 'women and Judaism' is not practical. You have to narrow it down."

Director of the Institute for Computers in Jewish Life, Rabbi Irving Rosenbaum, is looking forward to the day when the Responsa Project will become a global database, with research centers in many different locations around the world. Eventually, personal microcomputers will be able to gain access to the Responsa database, bringing the service into individual homes. It's an ambitious project that attempts no less than uniting an entire people in and through computers.

The elder Rosenbaum feels there is no conflict with being a serious religious leader and a user of high technology. "The computer is mind-boggling, while at the same time it suggests new juxtapositions. In a nominal way, it's creative."

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Software Degree a First

Seattle University Students Design Computer Projects

In June of last year, twenty-two Seattle University students made history of a sort when they received the master's of software engineering degree—the first of its kind.

The program participants, mostly working industry professionals who attended classes at night, learned about software engineering, system analysis, system design, implementation, and validation. Taking two courses per quarter over a two-year period, the students focused on such topics as database design, data security, computer graphics, and human factors.

Seattle University initiated this unique degree program in 1979, but the work of creating it began a couple of years earlier. A similar program, started in 1980, can be found at the Wang Institute of Graduate Studies in Tyngsboro, Massachusetts.

The intent at Seattle University was to devise a program that would emphasize practical, usable applications, complementing the existing computer science department, which emphasizes more theoretical concerns. For help in designing the preliminary curriculum, the university turned to Boeing Computer Services, a big name in computers in the Seattle area. Boeing also supplied some of the necessary funds, as did Weyerhauser, a large wood products company in the area, and Alcoa Aluminum. Hewlett-Packard of Menlo Park, California, contributed the computing system that's used—an HP-3000.

When it came time to implement the program, the administration sought the expertise of Dr. Kyu Lee, whose experience with computers includes being a specialist at Fermi National Laboratory, teaching computer science courses at various universities, and working for E G & G, a high technology firm, in real-time systems and management. Lee teaches some of the program's classes himself, while the other courses are conducted by faculty members Eric Frankel and Robert Glass, or by specialists brought in by Lee from the business community. A course on data security, for example, would be taught by someone who deals with this issue all the time, most likely someone from a bank or from a large corporation like Boeing.

At present, some ninety students, representing about forty companies, are enrolled in the program. Admission requirements in-

WARNER REELS...

from page 13

share, mostly on the basis of Atari's strength.

Investors little noted nor long remembered the chinks in Atari's armor. It didn't seem important that Atari's computer line was slow—or perhaps retarded is a more accurate assessment—in capturing public fancy. It didn't seem germane that Mattel, Coleco, Milton Bradley, and others were taking dead aim at Atari's VCS market with more advanced machines. The Vic 20 and the TI 99/4, priced competitively and full-bodied computers instead of just game machines, appeared to be only nuisances.

Atari appeared to have the hot machine and the hot software, led by *Pac-Man*, and an unstoppable momentum. Alas, for Atari, the old adage that there's nothing older than yesterday's news may be replaced by one that says there's nothing older than yesterday's technology.

The company was absolutely ponderous in getting product to market. In December of 1981, they reported back orders of between two and three million units for *Pac-Man*. But they couldn't bring the game to market for several more months. What was worse, when they did bring it to market, it was only a pale version of the arcade favorite. Rumor has it that Atari has warehouses full of unsold *Pac-Man* units.

None of Atari's other software captured the imagination of new buyers either, and Atari didn't have the rights to *Pac-Man*'s successors in the arcades—*Donkey Kong* and *Frogger*. Even souped-up sales of the Atari 400 and 800 computers couldn't offset the inroads being made by Mattel and Coleco in the VCS market.

So it came to pass in December that Warner somewhat shamefacedly reported that their earlier earnings projections for the last quarter of 1982 were too high. Actual earnings would be much more modest. And Atari's performance was being blamed.

To an investment community that had come to believe that silicon was beautiful, Warner's Atari announcement had the impact of heresy. Warner stock did not open on the day of the announcement until there were only ninety minutes left in the trading day.

Then it dropped $1.3 billion (that's no

clude a minimum of two years' experience using computers and the bachelor degree in some "quantitative discipline." Majors that fit this category are computer science, mathematics, and engineering, among others. In addition, students must be able to program, preferably in Pascal, C, or some other structured language; Cobol is also acceptable.

According to Dr. Lee, "The goal of the program is to teach software professionals how to design and/or manage a reliable software system." Students in the program follow out the "software life cycle, learning how software is produced and maintained from conception, to development, to delivery, to termination of the product." In addition, says Lee, the program puts a heavy emphasis on management techniques and communications skills that participants will need in their future work as software designers and project managers.

The culmination of the program is the nine-month-long "software laboratory," in which all students take part. Breaking up into teams of three to five, they create "a fairly decent-sized software system," going from conception to delivery. "The approach is a rigorous one," says Lee, "since all analysis, design, and implementation must be done properly."

The projects that students work on during this phase of the program aren't meant as mere exercises. They're suggested by someone at the university or by someone in the business community who sees a need for a particular kind of software system. During the "requirements definition" phase, students and their clients discuss and spell out what's needed, in an effort to ensure that the final product is something that will be really useful.

Some projects are completed by the original teams that started them. Among the systems completed so far are an accounts payable system written in Cobol, a library circulation system (also in Cobol); and an ultrasound simulation in Apple III Pascal that's designed to teach scanning techniques to medical professionals. An example of an ongoing endeavor is Lee's own pet project—a relational DBMS on the IBM pc, to which the students are taking a subset or "phased" approach.

During the software laboratory portion of the program, the project manager position rotates. This gives each student the chance to learn and practice the special kinds of skills the role requires.

When a project is in the analysis stage, a major part of the project manager's job involves getting the full cooperation of all team members. If one or more team members are lagging behind the rest, it's the team leader's responsibility to motivate them. If all else fails, there's a mechanism, similar to firing, for dealing with a student who just doesn't manage to perform adequately. So far, though, says Lee, "we haven't had to use it."

typographical error) in value in the next week. When Warner went, it took just about everybody with it. Down went Mattel, dropping in value by nearly $200 million in a bear market that caused its stock not to trade for a day and a half while order was being restored. Coleco stock dropped. Imagic had to postpone a planned public offering.

Under the category of it never rains but it pours comes more bad news for Warner. Investors had previously discounted an upstate New York theater scandal involving two Warner directors. It's alleged that they got caught with their hands in the cookie jar in a strictly minor league scam about a decade ago. One served on Warner's three-man office of the president, while the other was treasurer. Worse news, coming as the company's stock was plummeting, was informal implication of Ross in the illegal doings. No charges were filed, but it added fuel to the fire.

Then came news that Atari's chairman, Raymond Kassar, dumped a large block of stock the day before the revised earnings estimate was released to the public. The Security and Exchange Commission's rules specifically forbid individuals with inside information from taking advantage of such data. Kassar says the sale was part of an end-of-the-year tax strategy planned and executed prior to his knowing of the earnings downturn and that he tried to stop the sale when he learned of it. He's cooperating in an investigation, but Warner stock took another buffeting.

It'll be awhile before investors swallow Warner estimates whole. But the underlying weaknesses seem still to be going unnoticed. Little mention is made of the maturation of the market. And less mention is made of the stiffer competition from low-priced computers.

Even the top-of-the-line models are now siphoning off sales that might have previously gone to the VCS machines. George Schuetz of Computerland of South King County, Washington, serving the Seattle area, notes a change in the type of customers the store now gets. Schuetz says they're more knowledgeable about their options and know better what they want. And, even though the $300 computers are selling in every drugstore and discount department store, Schuetz says people are coming in to buy Apples and IBM Personal Computers.

Warner may have a tough time recapturing that $1.3 billion.

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news bits

Δ CAFE—Computer Aided Film Editing. Last November Eastman Kodak Company introduced Datakode, a new product for coding motion picture film that the company believes will help cut feature film postproduction costs by 50 percent. Datakode consists of a transparent magnetic oxide coding across the back, or nonsensitive, side of either sixteen or thirty-five millimeter film. It enables filmmakers to record machine-readable production data, which can be computerized for postproduction work. Editors can store, retrieve, edit, and cut the film faster, according to Kodak. Nearly all the noncreative, repetitive manual work of postproduction can be automated. Datakode will be available by mid-1983 and will cost around two cents per foot.

Δ Over Here, Part Two. Late in 1982 the Semiconductor Research Corporation, funded cooperatively by several large American semiconductor companies (**Softalk for the IBM Personal Computer,** June 1982, page 48), announced its first research contracts with universities. Just under one million dollars will go to Cornell University for research into microstructures. Eighteen faculty members and a group of graduate students will investigate the properties of integrated circuits with minimum dimensions measured on the scale of atomic spacings. A total of $1.75 million will go to the University of California at Berkeley and Carnegie-Mellon University for joint research in computer-aided design of integrated circuits. The Semiconductor Research Corporation also awarded five smaller research contracts to university groups that proposed innovative research ideas related to very large-scale integrated circuits.

Δ An American Computer in London. Do you ride in taxis frequently? Do you live in London? Are you tired of hauling out those big pound notes every time you take a spin to Westminster Abbey? Then London-Wide Radio Taxis has a deal for you. Thanks to a Honeywell small computer system, regular customers can run up a tab with the taxi company and be billed monthly. All incoming telephone calls are handled automatically by the microcomputer-based system. With a communication system in each cab, a driver is given an assignment and details of the finished jobs are stored for automatic accounting. Monthly statements are prepared for drivers, showing a breakdown of their earnings, while invoices are automatically produced for credit account customers.

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East Coast Computer Film-maker Creates Works of 'Pure Art'

Lillian Schwartz is an East Coast artist who says she needs to work in the materials of her time like she needs to eat and sleep.

In the sixties, one of her sculptures, *Proxima Centauri,* combined some of the mechanics, effects, and textures of the era. It was a large black minimal structure topped by a plastic dome, on which slides were projected. A proximity detector caused the dome to recede into the black unit when a viewer stepped close. A water tank above the sculpture bathed it in ripples, giving the surface of the piece a gelatinous look.

Schwartz's mysteriously kinetic work of art was chosen to be displayed in The Machines Exhibition at the Metropolitan Museum of Art in 1968. It was placed next to a computer-generated graphic, *Studies in Perception I,* that was created on a mainframe by a scientist at Bell Laboratories in Murray Hill, New Jersey. Schwartz was immediately smitten by the graphic piece, and says she "was all over it to see how it was done." Her enthusiasm eventually led her to become an artistic filmmaker using one of the most sophisticated tools of her time: the computer.

Her numerous short films made over the last decade have won Schwartz international recognition, and she continues to receive commissions for more. Best known for her experimentation with new technology, she is a pioneer in the use of the digital computer as a medium in the arts. She believes her access to the largely unexplored canvas of the

CHICAGO COMPUTER ARTIST...

from page 12

tana, a three-minute color videotape complete with stereo sound. Every year Veeder takes a trip into the western mountains, and *Montana* is an attempt to capture her "love [of] the physical world out there and its attendant information aura."

Montana features a number of forms (mountain, hawk, buffalo, earth, Sears Tower, video camera, and more) made all very simple (in the way the Japanese mean it). Veeder took these simple forms and developed the visual relationships with a fluid program of her own design. The program enables her to draw with any of a collection of "snaps" (screen sections stored as arrays) and tools to make lines, boxes, and other shapes. She worked on the piece for a long time, producing a dynamic, arresting audio-visual experience.

Veeder and her partner Phil Morton are only two of many computer artists living

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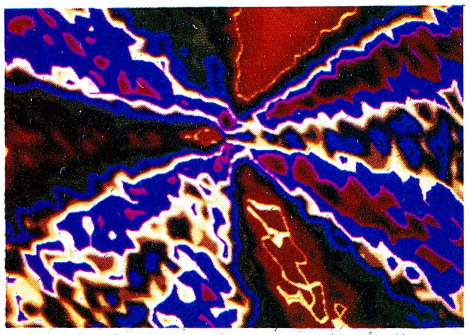


One image from Schwartz's most recent endeavor, an untitled work still in progress.

computer has defined her role as an artist: to develop the computer as a tool for pure art.

When Schwartz began her work at Bell Labs by invitation in 1968, computer art was in its Stone Age. Artists worked only in black and white, programming was done on punch cards, and "interactive" was a concept still in the works. Her first piece, a still graphic entitled *Head,* was produced under these restrictions on an IBM 360-50 mainframe. The system she used allowed her to scan and digitize a drawing of a head, using tiny face symbols to replace the gray values.

"I had always used sound and motion in my sculpture," she explains. "When I discovered that a simple change in the computer's instructions created a variation, animation was the next logical phase for me. The computer pushed me into it after about a year." Then came a commission to do a computer-generated film.

The film was a four and a half minute abstract entitled *Pixilation,* made in 1970. "If you were lucky back then, you turned in your punch cards and got a tape with eighty-five frames on it the next day. At twenty-four frames a second, I thought I'd never get it finished," she says. "I ended up animating half of it by hand, frame by frame. The programming consisted of throwing on boxes, 2-D squares and rectangles, using the random number generator for variation. Then I worked on an optical bench to give it color."

A television interface became available to the artist in 1974, allowing Schwartz and her computer science co-creators to shoot a series of animation frames off a monitor. "It was our first controlled shooting," she explains. "The programs could be written and run all night. We would compute, then shoot. However, we lost some resolution in the process, but at least we were out of the Dark Ages. Up till then, you could only see what you were doing in your head."

The technological advantage of a PDP 11-45, with a digital drum that could store pictures, allowed Schwartz to preview her work for the first time. "We were free to make decisions and edit in the computer," she says. It also had the video interface she had found so liberating. She used real-world input, pictures of birds, for her film *L'Oiseau* that was created using this system.

A new phase of mixed media opened up for Schwartz when she gained access to a PDP 11-40 with a video/visual communication system attached. It was used to make a film of choreographed dancers, done in false color, in 1978. The system allowed the storing of images in a camera and the frame numbers in a computer, facilitating the easy manipulation of images and the mixing of live-action footage with animation. The editing process for Schwartz became a little like playing a musical instrument. *Poet of His People,* a documentary on Chilean poet Pablo Neruda interspersed with footage of narrators in a studio and images of dancers and sea birds, likewise evolved from this period.

Nowadays, Schwartz's computerized artwork is much more interactive than it was five years ago. "I can really apply a lot of technology to my artistic vocabulary by just using buttons and joysticks for preliminary sketchwork. We have unbelievable resolution and a choice of over 65,000 colors," she says. "I can make instant evaluations, compare palettes, display the choices, and make decisions."

Schwartz has also found that her way of thinking about art has changed as computers get more challenging as a medium. "They provoke me into ways of creating that would have been impossible before, opening up a whole new world of visual imagery.

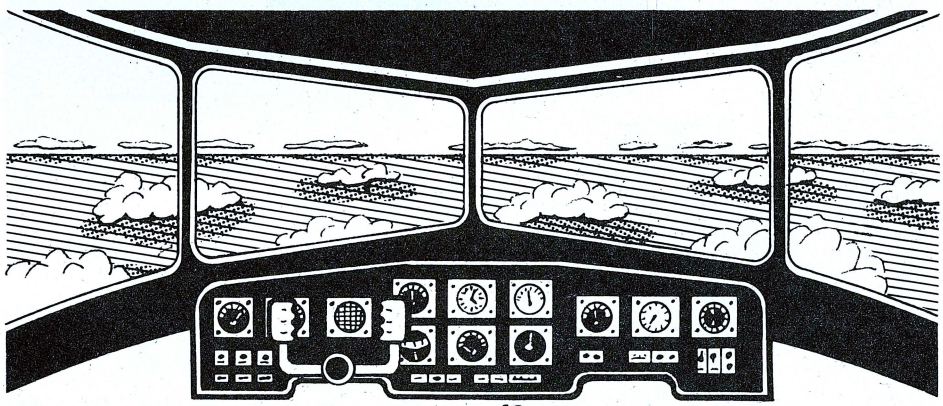
"I also find we're doing more pre and post production work now, not producing much in real-time anymore, except to conceptualize. Certain algorithms are used to smooth out the edges of an image, and these take time to compute. I'm at a point where I'll trade real-time for better resolution." ▲

and working in the Chicago area. Tom DeFanti and Dan Sandin of the University of Illinois at Chicago Circle have been very influential, mainly through their own development of new graphics technology. "I'm standing on a whole bunch of people's shoulders," says Veeder.

Veeder came from the world of video synthesis, which she feels is quite wonderful but akin to sex. "It's not too interesting for those watching." She supports herself by doing outside consulting work in the Chicago area, mainly instructing people how to use the ZGRASS language. She also says she's extremely addicted to real-time computer graphics.

"I am almost completely uninterested in still images other than photos for promotion or documentation. Real-time graphic performance resulting in a dynamic visual process is my priority and the motivation for my continuing growth as a programmer."

Living in a slum or not, Veeder is making history in computer art.



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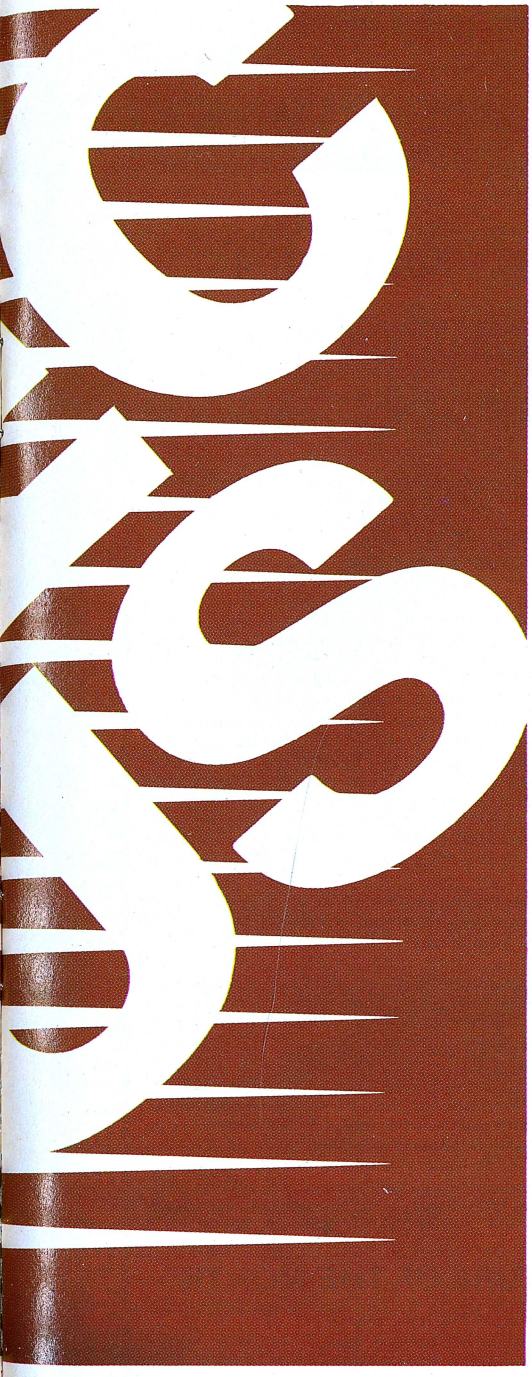

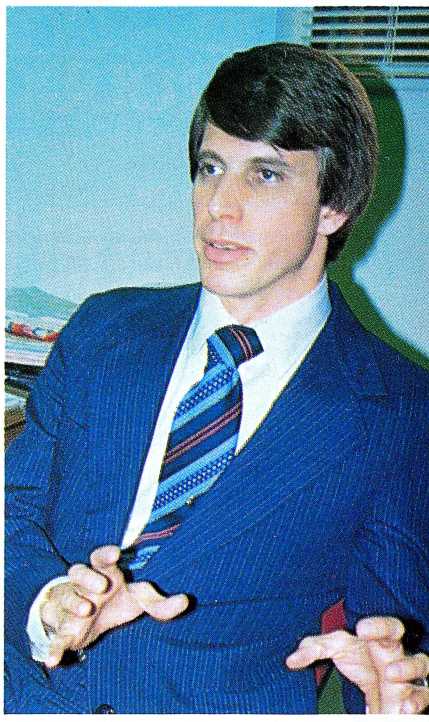

Bill Baker (opposite, above) founded the business, originally operating from a closet. Paul Chaison (opposite, below) became his vice president for research and development after twenty-two years at IBM. Bill Lohse (top left) is vice president for marketing, and Norm Lancaster (top right) is vice president for accounting and administration. Above, Baker leads his group in "I'm a Deleter."

It's Saturday night. "Bill Baker and the Diskettes" are belting it out to a laughing crowd, having temporarily preempted the Beatles look-alike band.

Flushed with champagne, and revenue from its *EasyWriter* programs, Information Unlimited Software is celebrating its fifth birthday. In a sense, though, the story is three times that old.

Soldering Together a Future. Bill Baker had been interested in electronics since he was a twelve-year-old Indiana boy, soldering radio kits after school. He brought his enthusiasm with him to Indiana University, where he majored in telecommunications and business administration. Meanwhile, he did summer work at the Gary National Bank, starting as a coin wrapper.

One day, Baker saw a microcomputer in the home of a fellow radio hobbyist. It was a Polymorphic computer, a primitive orange box of a machine sold through the mail in kit form. He just had to order one immediately.

Baker soldered and tinkered, tinkered and soldered, and finally brought the thing to a friend who was an electronic engineer; but he never did get it working. It turned out that the way he had put it together was right, but the wiring diagrams he had received with the kit were wrong. The experience made him a believer in customer service. It also led indirectly to an opportunity.

"One day I had a memory board on my desk at the bank. The manager asked me what that thing was, and for the next half hour

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ACP can also help your firm or yourself to configure a custom application utilizing the IBM PC or even a popular portable IBM PC compatible computer. Our design team will analyze your requirements and recommend what we feel is the optimum solution to your application. If you desire this service, simply drop us a line or contact us via the Toll-Free line and we will be happy to assist you with **no** obligation.

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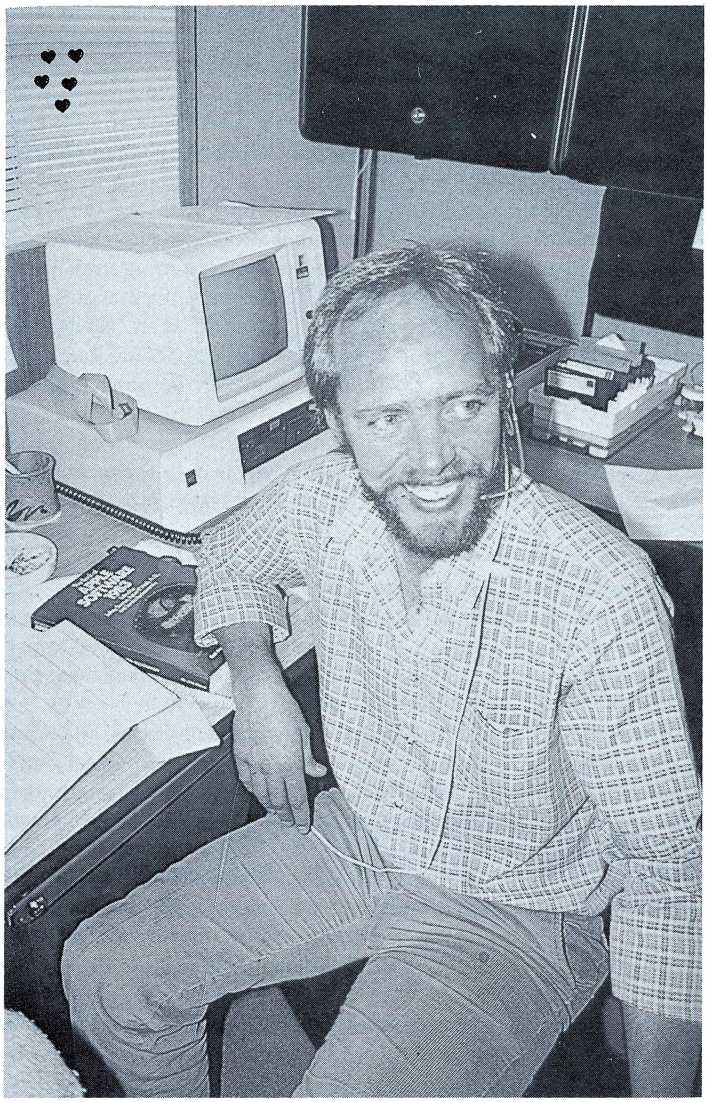

Rich Brown mans a customer service hotline at IUS's Sausalito headquarters.

he was listening to my story about the microcomputer. Three or four weeks later, I was transferred to the data processing department."

He was creating a fine career at the bank, but he just couldn't forget about microcomputers. "I wanted to find out what all the companies were doing in the industry. I decided the best way to do it was to tell them I wanted to be a dealer. So I thought up a name and had some stationery printed. Then I sent out a letter saying, 'Send me your dealer kit.' "

That was 1977. A friend named Lyall Morrill had written a simple database program called *Whatsit* ("*W*ow *H*ow'd *A*ll *T*hat *S*tuff get *I*n *T*here?"). Baker volunteered to market it for him. He bought a sheet of fiberboard and some two-by-fours to make a shelf in his closet for the inventory, placed an ad in *Byte* magazine, and soon was sending out copies COD.

Before long the business was too big for his closet. There were too many orders and too much bookkeeping. Baker hated bookkeeping.

That was when he met Joe Alonzo. Alonzo was an accountant and had an office. Those were two things Baker needed very badly. Alonzo was also interested in computers. The two of them sat down and made a deal.

Alonzo remembers it like this: "I said, 'Why don't we incorporate.' He said, 'I don't know anything about that.' I said, 'I do.' So we incorporated. Then we had to decide who were going to be the officers of the corporation. I said, 'What do you want to be?' He said, 'I don't know.' I said, 'You be the president and I'll be the treasurer.' " IUS was born.

California, Here I Come. Things went smoothly for a while. Then the business that had started in Baker's closet started to outgrow Alonzo's office. And there was another problem.

Baker remembers, "California was calling me. I was spending more time in California than in Indiana. Many times I would take a Friday off from the bank to go to a computer show. I would put all my computer stuff on the plane in Chicago and set up my booth in L.A. Thursday night. I would do the show Friday, Saturday, and Sunday, then take the red-eye flight back to Chicago and get in about five a.m. I'd check in at a Holiday Inn near the bank, then change clothes and go to work. I did that many, many times."

Eventually, in 1979, Baker told Alonzo he had to move to California. Alonzo said, "Don't hesitate. Just go." So Alonzo, who still lives in Indiana, sold back his IUS stock. *His* story doesn't quite end there, however, because he now has his own company, Omni Software Systems, and is marketing software for the accounting profession.

Meanwhile, Baker's compulsive fair-going was starting to pay off with some valuable contacts. One was John Draper. Baker remembers: "We had two booths showing *Whatsit* at the second West Coast Computer Faire. John's friend Matthew McIntosh went up to Adam Osborne and asked him what would be a good company to market a word processor. Adam pointed at our booth because we had a pretty large booth and there were only a few software companies at the show. I went downstairs with Matthew. There was John Draper demonstrating his program to—guess who—Dick Heiser, the guy who opened the first computer store in the country. Dick said, 'You've got to see this, Bill. This'll blow you away. I want the first fifty.'

"I looked at it. There was only the skeleton of an editor, but the concept, the way it was scrolling and so on, was terrific. I went to John's place and we worked out a deal. I put the money up front to have them finish the product." The product, of course, was *EasyWriter*.

It was the first word processor written for the Apple, and, for a while, the only one on the market. Other programs have since eclipsed its popularity, but in 1979, it was a godsend for thousands of computer hobbyists.

What was it like using the original *EasyWriter*? Compared to the word processor you are used to, it was probably awful. The screen was forty columns. The Apple had only uppercase letters, so you capitalized by hitting the escape key, which caused the capitalized letter to appear inverse (dark letter on light background). There were no function keys, insert/delete keys, or up/down arrow keys. All of these things had to be handled by some combination of the control key and a letter key. The text appeared on the screen with no regard for indents, spacing, line length, margins, or page size. These were controlled by embedded commands, little snippets of code that took a long time to learn. If you could print a ten-page document without having the text from page six run over on page seven, you were doing great.

It was like driving a Model-T Ford. But don't forget that the Model-T Ford was a fine car for its period. It didn't perform like a Cadillac De Ville, but the Cadillac De Ville was not an option then.

Cadillac Computing. These days, you can get a Cadillac computer, courtesy of International Business Machines, and a Cadillac word processor to go with it. In fact, there is a choice of two *EasyWriter* programs for the Personal Computer. But this happy state did not come about without some hardship and unpleasantness.

EasyWriter was already losing its share of the Apple market when IBM chose it for the new machine. It's hard to say why Big

Blue chose *EasyWriter* over, say, *WordStar*. It might have been for the same reason *VisiCalc* was picked over *SuperCalc*, and *Adventure* over *Zork*. It had a well known name. It was also simple, reliable, and inexpensive.

Whatever the reason, IBM lit a fire under Baker to get the program ready for the new machine's August, 1981, release date. "We did the whole project in three months. That's three months working every weekend and late every night. We really didn't have time to do things like hardware scrolling, so it was slower than it might have been."

That's a charitable way of describing it. Version 1.0 won the headline "Not-So-EasyWriter," something that still raises hackles at IUS. Reviewers complained not merely that it was slow, but that it tended to delete text under apparently innocent circumstances. Some simple functions like underlining, which one expects these days from any word processor, seemed to be impossible.

Even as Version 1.0 was being released, IUS was working on a faster, cleaner version. In May, 1982, IBM released Version 1.1, giving copies as free replacements to users who had the earlier program. *EasyWriter*'s sagging popularity began to rebound. T-shirts with the slogan, "I Survived EasyWriter 1.0" appeared in the company's Sausalito, California, headquarters.

Nevertheless, Baker thinks Version 1.0 got a bum rap. "It's ten times better than the one we had on the Apple, but people have higher expectations for products with the IBM label."

No one ever got rich outguessing Bill Baker. At the same time that he was developing a word processor for IBM, a Canadian company called the Basic Software Group was developing a word processor for him. BSG's *EasyWriter II* hit the market about the same time as Version 1.1, and immediately started to steal the show. Dealers report strong sales for Version 1.1., but they report even stronger sales for *EasyWriter II*. That may sound strange when you consider the fact Version 1.1 bears the IBM brand and sells for half the price.

A comparison of the products clears up some of the mystery. IBM asked for a translation of *EasyWriter*, and that's what it got. It is a good translation, in many ways better than the original. But it's only a translation. Even Version 1.1 relies heavily on control keys and embedded commands. And even in Version 1.1 it can be difficult to underline.

An IBM with *EasyWriter* is like an Apple with the same program. But an IBM with *EasyWriter II* behaves more like a dedicated word processor—a Wang or a Displaywriter. The program is better structured, more orderly, more able to take advantage of the computer's capabilities. In short, IUS's *EasyWriter 1.1* is an excellent example of what can be done with an existing program, but *EasyWriter II* is an excellent example of what can be done with the machine.

The Other Easies. By now, it may seem that IUS is a one-product company. That isn't the case. *EasyWriter* is only the most popular of a growing family of programs that boast compatibility and easy use.

For example, there's *EasySpeller*, a spelling checker with a ninety-thousand word vocabulary. You can increase its vocabulary by making your own lists of words for checking. There is *EasyFiler*, a database manager that can be used with *EasyWriter* to create personalized form letters. There's also *EasyPlanner*, a spreadsheet program compatible with both *EasyFiler* and *EasyWriter*.

New from IUS is the Financial Management Series, including *General Ledger*, *Accounts Receivable*, *Accounts Payable*, *Order Entry*, *Inventory Control and Sales Analysis*, and *Payroll*. The programs in the series are mutually compatible, so that information can be transferred freely from one to another.

IUS also offers a unique service—subscription phone support. When you buy a piece of software, you have the option to pay an extra fee that pays for a subscription to a technical newsletter and the right to call the IUS technical hotline. No question is too simple or too complex.

While some might complain that other companies offer phone support for free, Baker points out that in those cases costs are simply added to the company's overhead, and hence to the price of its products. "If you don't want the service, you shouldn't have to pay for it," he says.

The People behind the Programs. In the long run, it is not the products that make or break a company, but the people who work there. Baker believes in his company and hires people who believe in it as well.

IUS is a privately held corporation. Privately held, that is, by its employees. Taking a job there means a cut in pay from your previous job. But it also means becoming a shareholder.

You might think that only a fool would trade a fat salary for shares in a company with an uncertain future. If so, Baker has been very lucky, because he has managed to attract some highly talented fools.

One is Paul Chaison, who until recently was employed by IBM in Boca Raton. He was employed by IBM for twenty-two years. Having someone like Chaison on your side might be an advantage, especially if he is your vice president for research and development.

Chaison has more than a little familiarity with different kinds of computer hardware, as the stripped-down Compaq computer by his desk testifies. When he has the choice, though, he prefers the IBM for personal use. "I saw what went into that computer. And IBM has the best service I've seen."

The other employees credit Chaison with bringing IBM quality standards to their company. The changes he makes today will influence IUS for a long time to come.

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another vice president has been busily restructuring the accounting system. Norm Lancaster's accounting work may not be as glamorous as R&D, but it is very important to the dealers on whom IUS depends.

In today's shaky economy, it is easy for a company to build up a huge accounts receivable and be forced to reclassify a lot of it as "bad debts." The problem, says Lancaster, has to do with discounts. If a dealer buys a couple months' inventory at once, he might get a 30 percent discount, but if he buys a whole year's inventory at once, he might get a 50 percent discount. That kind of system encourages a dealer to accumulate huge debts and put off paying them as long as possible.

Lancaster says it makes more sense to base discounts on a good faith estimate of the dealer's needs rather than the bottom line on a single order form. "I tell people, 'Rather than have you buy big chunks, I'd have you buy small chunks more often.' "

Vice presidents come in threes, at least at IUS, and the third is Bill Lohse, who is responsible for marketing. Whereas Lancaster is a professional pessimist, keeping an eye on bad debts, Lohse is a professional optimist, tasting new market opportunities. "You don't have to have the best products to have the best sales," he says. "Of course, we do have the best products."

Lohse has a good background in this theory of marketing, since his college major was philosophy. He liked philosophy, but he didn't like teaching, and openings for philosophers were few. So, in 1976, he took a job selling Imsai computers. The Imsai was an idea whose time came and went within the space of a few years. (Only the associated chain of stores remains; it's called Computerland.) Lohse stayed in the industry and grew with it, eventually becoming director of sales for MicroPro.

Last year, he came to IUS. He liked the company's attitude toward its customers. He feels it has not only good products but also the training, support, and documentation that many customers require. "It's not enough having good products. It's that second sale that's important."

New Directions for IUS. Strengthened by this bright, capable team, IUS is scouting new vistas in the computer world. One is the expanding domain of MS-DOS. Machines built around MS-DOS have been proliferating, and IUS hopes to win a part of this market. The company is greatly expanding its product line this year, and most of the new programs are written for MS-DOS machines.

However, IUS has learned something from its experience with *EasyWriter*. It doesn't want to write programs just for the operating system; it wants to write programs for the individual computers. Bill Lohse puts it this way: "The average owner doesn't care if the program runs on a North Star or a Xerox. He wants a program designed for his machine."

IUS is also exploring the new markets blossoming in Europe and Japan. This effort involves more than rewriting the documentation for foreigners. It means alteration of the character set—a fundamental change to the product. It also means adapting the program for people of a different culture. However, from its Sausalito office, IUS hasn't had much trouble recruiting people with foreign backgrounds. Paul Chaison says, "The Bay area is cosmopolitan. If we were doing this work in Bangor, Maine, we might have more problems."

Competing on the world market is exciting stuff for twenty-seven-year-old Bill Baker, whose office five years ago was a closet in Indiana. "We started with no money. I tell people you can do anything you want for no money. Every major company, when you go back far enough, started on a shoestring. It's not the money that's important. It's the idea." ♥♥♥♥♥ ▲

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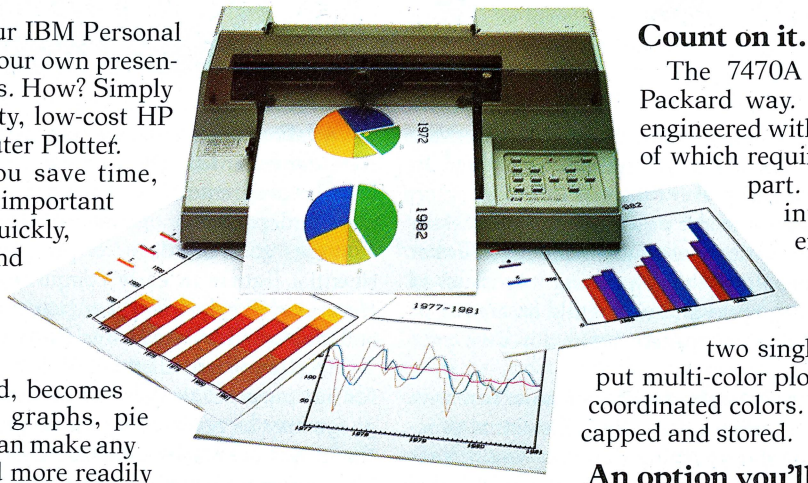

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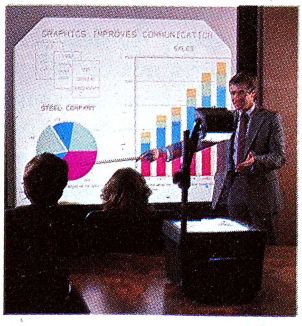

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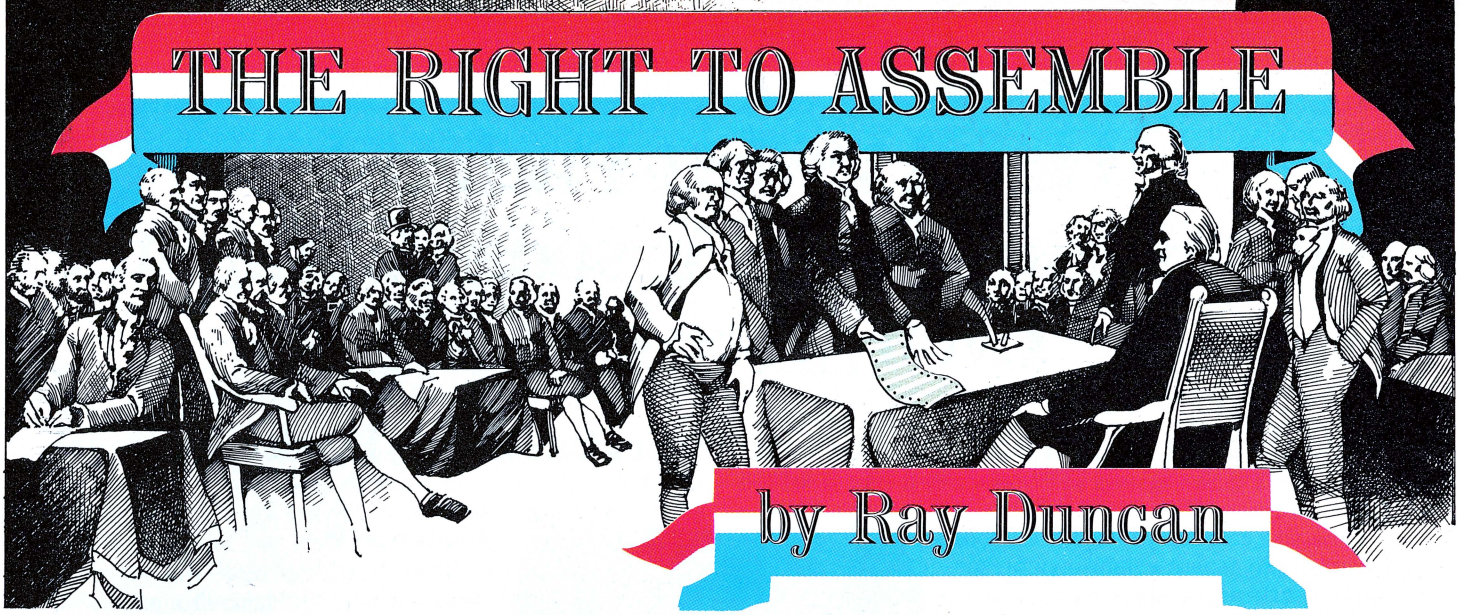

by Ray Duncan

This month we introduce a new column devoted to assembly language programming topics for the IBM Personal Computer. In the coming months, this space will present tutorial information on the architecture and instruction set of the pc's 8088 microprocessor and on the operation of the various assembler/debugger/linker packages available for your machine. We'll be getting into issues of assembly language programming style, and we'll build an arsenal of useful subroutines that you can incorporate into your own programming projects.

What Is Assembly Language? As you probably know, when we say the microcomputer is "executing a program," the actual process that is going on doesn't involve anything that you would readily recognize. The actual commands or "machine instructions" that drive the central processing unit are simply binary patterns—strings of 1s and 0s. Each 1 or 0 is called a *bit*; a *byte* is a group of eight bits and is usually the smallest amount of information that can be fetched from memory in a single operation. There is a register in the microcomputer called the *instruction pointer* (IP) that always contains the address of the next machine instruction.

Although instructions vary in length (a single instruction may contain anywhere from one to many bytes), each instruction is an indivisible unit to the programmer, and each causes the CPU to perform one operation on data or on the instruction pointer. The set of bytes that makes up one machine instruction is subdivided into one or more *bit fields*. There is always a major field that tells the microprocessor the class of operation it's to perform. There may also be a number of minor fields that provide the processor with such supplemental information as the length of the instruction, the size of operands, and the addressing mode.

The earliest computers were programmed by hand directly in the binary language of the computer. As you can well imagine, this was a tedious process and highly prone to error. In addition, once the program was written and running, the programmer's problems had only begun. Whenever the program needed to be changed in the slightest way, the machine code would have to be "patched" by means of a jump out of the main line of execution to some extra code squeezed into any free memory that could be found. The alternative to jumping to a patch outside the main line of execution was to insert the new code in-line, in which case every single address reference in the program had to be recalculated and fixed by hand.

It eventually dawned on everyone that the computer could be used as a symbol manipulator as well as a fancy adding machine. This sounds trivial now, but it was a major conceptual breakthrough at the time—the early 1950s. Special programs, called *assemblers*, were created that could convert symbolic names for operations and locations into the actual binary machine code required by the computer.

At about the same time, the first high-level language compilers were implemented. The purpose of high-level languages was to allow the programmer to express a program in a more natural, machine-independent, algebraic notation. Some fascinating accounts of these "good old days" of programming, written by the most influential figures in early computing, can be found in the book *A History of Programming Languages*, edited by Richard Wexelblast and published by Academic Press (1981).

The important distinction between compilers and assemblers, for our purposes, is that one program statement in a high-level language may be resolved by the language's compiler into many (even thousands of) machine instructions, while one statement in assembly language virtually always translates into *one or fewer* machine instructions.

Why Assembly Language? In these days of bigger and better high-level languages, why would anyone still want to bother with assembly language programming and get all tangled up with addressing modes, registers, status flags, and all the rest?

There are a number of reasons.

High-level language compilers tend to create bulky code. The Microsoft compilers for the pc are particularly notorious for this. A two-line program to print "hello" and exit will be turned into a 10K executable file by Microsoft's *Basic Compiler*. In contrast, it is not difficult at all to accomplish the same task in about twenty bytes of assembly language. Of course, at the rate that memory costs are decreasing, this argument will become less forceful as months go by.

Second, compiled code tends to be relatively slow, compared to assembled code. Compilers are general-purpose tools designed to produce acceptable code for any sequence of operations the programmer might dream up; because of this generality, they are usually not good at exploiting the special features of the machine in order to produce really tight, fast running code.

Naturally, the efficiency of the code generated by a compiler can vary enormously, according to the cleverness and insight into the machine architecture possessed by the compiler's creator. Again, the Microsoft language products are good (or bad) examples of compilers that produce inefficient code. In the benchmark tests published in the November 1982 issue of *Creative Computing*, the programs compiled with Microsoft languages ran from seven to seventy times slower than the code produced by the Lattice C Compiler. But even the "smartest" compilers, such as Digital Research's PL-1 or Whitesmith's C, rarely generate code that is more than half as fast as the code written by an experienced assembly language programmer.

Finally, high-level languages are by intention portable; that is, they're designed to be implemented and used on many different types of computers. As a consequence, they are not well equipped

for writing programs that are highly machine oriented. The complex, hardware-dependent operations that are necessary to control a disk drive or a video interface are prohibitively clumsy to express in most high-level languages (PL/M and Forth are notable exceptions).

The computing purists will counter with the arguments that assembly language programs are difficult to read, unnatural in syntax, relatively difficult to debug and maintain, and nearly impossible to validate formally. Of course, the purists are right. And as compilers become more intelligent and memory becomes cheaper, the range of applications for which assembly language is an absolute necessity will narrow down. Witness the *Volkswriter* word processor for the pc, which is written in Pascal and has exceedingly snappy performance; up to now virtually every quality screen editor for microcomputers has been coded in assembly language.

For the present, if your projects lead you into the byways of hardware diagnostic routines, graphic displays, peripheral device drivers, telecommunications, process control, or data acquisition, you will find a knowledge of assembly language to be indispensable. And just as it is possible to write really dreadful, unreadable programs in Cobol or Pascal (and positively easy to do so in Basic), it is also possible to write modular, well organized, readable programs in assembly language—if you're willing to invest some effort.

Which Assembler To Buy? At the present, there are only two 8088 assemblers available for the pc. Each has advantages and disadvantages.

The first was written by Microsoft for IBM and is a true macro assembler with Intel standard mnemonics and extensive support for segmented relocatable code. It costs $100 and is available from all the usual pc dealers. Its deficits are that it is slow and it requires 96K of memory if you're going to use macros. A subsidiary drawback is the Microsoft debugging utility, which does not contain an interactive assembler to help you patch small errors in the assembled code.

The other assembler is Digital Research's Asm86, which is included with the CP/M-86 operating system sold by IBM ($240) as well as with the Concurrent CP/M-86 system sold directly by Digital Research ($350). Asm86 is a fast, clean programming tool that is a pleasure to use; it runs comfortably in 48K. The debugger (DDT86) supplied in the package includes an interactive assembler feature that makes it easy for you to patch minor changes into assembled modules. The CP/M-86 operating system itself also contains many more sophisticated executive services for the assembly language programmer than does PC-DOS. The drawbacks of Asm86 are that it lacks a true macro capability and it doesn't produce relocatable code.

When Digital Research finally releases Rmac86, which will have relocatable code and macros, the choice ought to be clear—if you are going to be heavily involved in assembly language programming. In the meantime, it's a bit of a tossup.

Reference Books. If you wish to become proficient in 8088 assembly language, you will find the following two books to be very helpful:

The 8086 Book, by Russell Rector and George Alexy, published by Osborne/McGraw-Hill, Berkeley, California, 1980.

The iAPX 86,88 User's Manual, available from the Intel Literature Department, 3065 Bowers Avenue, Santa Clara, California 95051. This book is also sold in many computer stores.

Leo Scanlon's book on 8088 language programming, to be published in the near future by the Robert J. Brady Co. (Bowie, MD), contains great tutorial information not found in either of these other books or in the two assembler manuals.

Next month we'll look at the architecture of the Intel 8088 microprocessor. ▲

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THE GRAPHIC

THE ABCs OF IBM GRAPHICS

by George Bohannon

One of the most advanced pieces of equipment available for the IBM Personal Computer is the IBM color/graphics adapter. This device performs an amazingly varied set of functions, only some of which are described by its name. The adapter can be used in either text or graphics mode, and each of those modes offers a choice of medium or high resolution. Moreover, the graphics mode, although intended primarily for use in the creation and display of pictures, also offers many of the text characters available in the text mode.

This is the first of a pair of articles covering material related to the use of the color/graphics adapter. The capabilities available in the graphics mode alone are enough to warrant several articles—so we'll restrict our discussion to that mode. Before proceeding, however, it's worth noting that text mode offers several features not readily available in graphics mode. These include blinking, reverse video, a choice of sixteen foreground colors (only three foreground colors are available in graphics mode), and the ability to maintain several "pages" of screen information in memory at once. It's possible to do some of these things in graphics mode (and, in fact, the sequel to this article will present a method of achieving inverse video in graphics mode), but they're more easily done in text.

Memory Lane. The pc uses a *memory-mapped* graphics display. That means that the computer devotes a large range of memory addresses to the control of the graphics screen, and every point on the screen is governed by a particular location in this memory range.

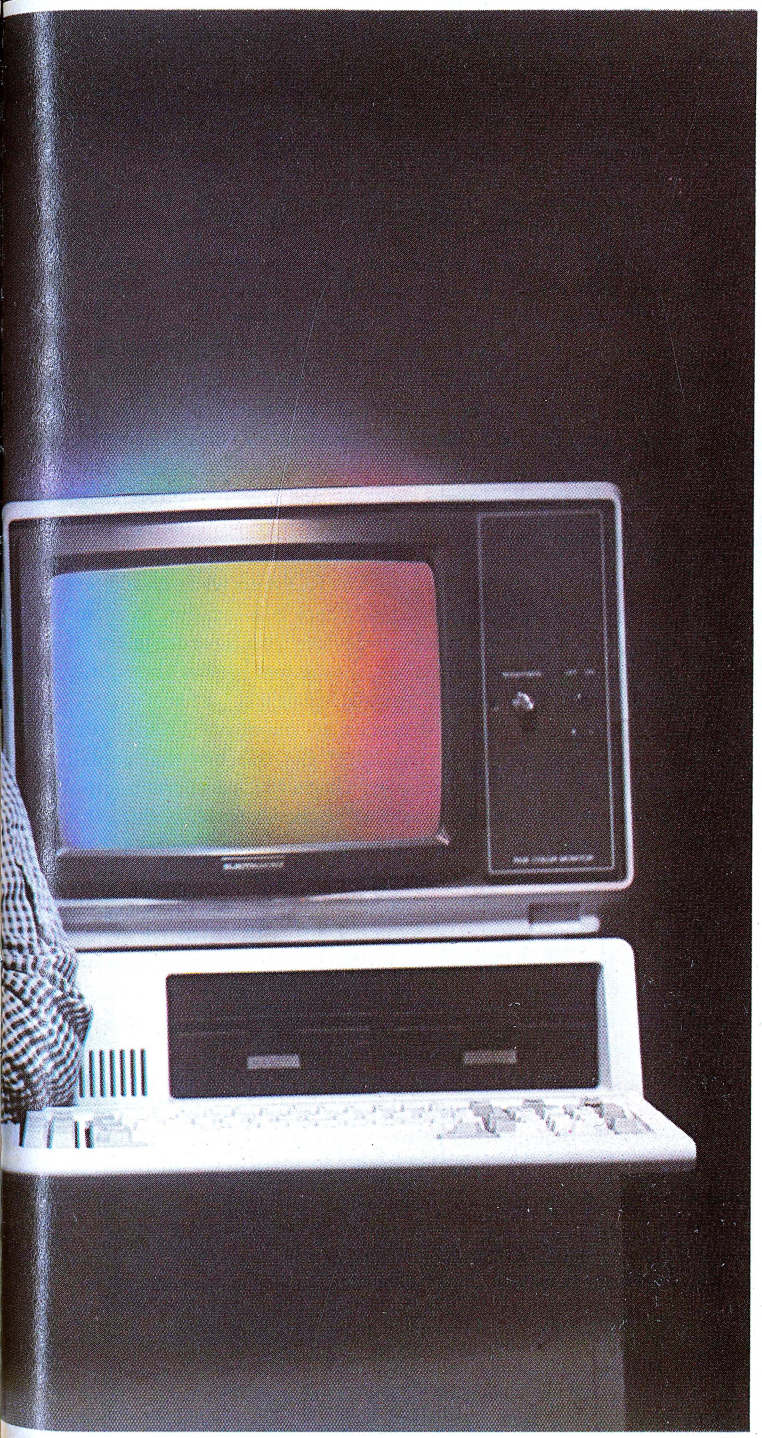
For mapping purposes, the screen is divided into picture elements, otherwise known as pixels, or *pels*. The portion of memory that controls these pels is known as a display buffer, or screen buffer.

To store information about every pel obviously requires a substantial amount of memory (although the amount required is not *that* large, considering the current low cost of memory and the pc's ability to address over a million bytes). It takes much more memory to control the screen in graphics mode than it does in text. That's because in text mode the computer only has to store one eight-bit ASCII code and an attribute byte for each character position on the screen.

The memory chips that hold the display buffer information are physically mounted on the graphics adapter, rather than being lo-

GOTO 34

THE MONOCHROME/ COLOR SWITCH



by John Socha

If you happen to be one of those pc owners who refused to opt for *either* color and graphics *or* the nice, sharp, high-resolution IBM monochrome display, but instead bought both display adapters, you may have noticed a problem. Not all commercial software is smart enough to recognize that you have both boards.

If your system normally comes up in monochrome, a well-made graphics program ought to see your graphics adapter anyway and direct its output thereto. But some programs are a little dumb. Some even have the gall to flash a message on your monochrome screen telling you to go buy a color board.

Here's a simple machine language program that will relieve you of having to cope with such software foolishness. Don't be frightened by the ominous words *machine language;* once you've followed the simple instructions in this article you'll have a DOS program that will enable you to switch between your two displays just by typing *switch*. You'll need no knowledge of machine language or of any of the fine details of your shiny new machine. All you'll need is DOS 1.1 (those of you who know and love assembly language can skip directly to the section on the assembly language program—or stick around for the fun).

Creating the Switch. We'll be using the program Debug.com, so you'll want to copy this from your DOS disk to your work or system disk. Do this now.

A few words about notation before we start the hands-on work. We're assuming that you'll have Debug.com in drive A, hence the A > prompt; in fact, you can use any drive you want. Enter all underscored text verbatim; the text that isn't underlined represents responses from your system. Much of what you're to type is printed here in capital letters, to avoid confusion between the digit 1 and the letter l; you can use lower-case letters if you prefer.

Debug is a program that we'll use to modify memory directly at the system level. We will deal with machine language—numbers that have no direct meaning to us but are meaningful to the machine. Such numbers are said to be machine-readable. Fortunately, Debug has an unassemble command that converts the machine-readable numbers into mnemonic instructions, like MOV AX,0040, which we can read more easily than pure digits and letters. We'll use these mnemonic instructions, displayed by the machine, to ensure that our program has been entered without errors. On to the session.

The first step is to enter the debugger. To do this, simply type the underscored text:

```
A>debug switch.com
File not found
```

Although *File not found* is an error message, it is precisely what we want; *debug switch.com* calls Debug and attempts to load the file Switch.com—which doesn't exist yet. But Debug has stored certain information about this nonexistent file for use later when we wish to write our machine language program onto the disk. The hyphen is Debug's prompt character (similar to DOS's A>). We are now ready to enter the machine codes for Switch.com:

```
-E DS:100 B8 40 00 8E D8 32 E4 8B
-E DS:108 1E 10 00 8B CB 81 E1 30
-E DS:110 00 33 D9 81 CB 10 00 B0
-E DS:118 00 83 F9 30 74 06 81 CB
-E DS:120 30 00 B0 07 89 1E 10 00
-E DS:128 CD 10 CD 20
```

That's it. We now have a program! Is it correct? Let's see. Type

```
-U DS:100 12B
```

to unassemble the machine code so that you can check our program at the mnemonic, human-readable, level. Except for the 04B5 before the colon on each line, you should see exactly

```
04B5:0100  B84000      MOV   AX,0040
04B5:0103  8ED8        MOV   DS,AX
04B5:0105  32E4        XOR   AH,AH
04B5:0107  8B1E1000    MOV   BX,[0010]
04B5:010B  8BCB        MOV   CX,BX
04B5:010D  81E13000    AND   CX,0030
04B5:0111  33D9        XOR   BX,CX
04B5:0113  81CB1000    OR    BX,0010
04B5:0117  B000        MOV   AL,00
04B5:0119  83F930      CMP   CX,+30
04B5:011C  7406        JZ    0124
04B5:011E  81CB3000    OR    BX,0030
04B5:0122  B007        MOV   AL,07
04B5:0124  891E1000    MOV   [0010],BX
04B5:0128  CD10        INT   10
04B5:012A  CD20        INT   20
```

Your program may have a number other than 04B5, depending on how much memory you have; Switch will work in any event. What if you've found an error? In that event, your best course is to enter

```
-Q
A>
```

to exit from Debug, and start over. Have faith: once you have the program entered correctly, you need not worry again about typing in Switch.

We're not done just yet. Enter the commands

```
-R BX
BX 0000
:0
-R CX
CX 0000
:2C
```

We've just told Debug that our program is 2C bytes long. What's this about 2C being a number? It is: 2C is a *hexadecimal* number, equivalent to 44 in our conventional, decimal numbering system. Ah. At last we can write our program, Switch.com, to the disk:

```
-W
Writing 002C bytes
```

and be done with this Debug stuff with a quit command:

```
-Q
A>
```

Let's see if it works, shall we? Enter *switch.* You should now see a wide A> prompt on your color screen with a blinking cursor just after the >. If you don't, you will probably have to reboot the system (with control-alt-delete), erase Switch.com and start over again. If you know more about Debug, you needn't start from scratch: simply change the errant bytes.

Type *dir* to display the directory listing. See how it fills the screen, from left to right? Switch sets the display to the forty character by twenty-five line mode. But if you would prefer to switch to the eighty character by twenty-five line mode whenever you change displays, enter the instruction

```
A>debug switch.com
-E CS:118
04B5:0118 00.2
-W
Writing 002C bytes
-Q
A>
```

Doing so changes the color-display mode from 0 (forty by twenty-five black and white) to 2 (eighty by twenty-five black and white).

How Does It Work? Inside your pc are five computer chips known as read-only memories (ROMs) which control many of the display functions. Whenever a DOS program sends characters to the display, DOS calls upon programs in ROM to write characters to the screen. Which screen, you ask? There is a location in memory that keeps information on which devices you have installed. If you have two display boards installed, the system knows about only one display—usually the monochrome display.

What if we change this information in memory? That is precisely what Switch does! Switch twiddles* the two bits that contain the display information. Pull out your *Guide to Operations* manual and flip to the page marked *Display 5-15* in the Options section; this is a small pamphlet that came with your monochrome display (or try page Display 5-33 in the pamphlet that came with your color graphics display adapter). See the switch settings used for the different display types? When 5 and 6 of Switch 1 are both down we've told the system we have the IBM Monochrome Display or more than one monitor. The system has no way of knowing whether we have just the monochrome or both monochrome and color displays, so it assumes we have only the monochrome display.

We can't change these switch settings under software control (no, there is no robot arm inside the machine). Instead, whenever you reboot DOS, these switch settings are copied into a memory location where they can be modified easily by software. Our program changes the 5 and 6 down setting to 5 down and 6 up (forty by twenty-five color), and *vice versa.* It then calls upon a program in the ROM to reinitialize the new display.

Those of you who have no interest in the details of the assembly language program can skip to another article; the next section is rather dry and technical.

*twid-dle /'twid- 1/ *vb*: COMPUTERESE: to change, to alter < ~ bits > twiddle *n*: a person, often with blood-shot and vacant eyes, who enjoys writing cryptic code to manipulate bits in a computer < bit ~ er >

The Assembly Language Program. If you have written and successfully run programs written for the Macro Assembler, much of the notation in listing 1 should be familiar, but the stack segment definition is missing. There are more anomalies, although they're somewhat subtle: this is a .com program, not an .exe file, and herein lie the differences between this program and those you've created with the Macro Assembler. But before discussing these differences, let us look at the program itself.

The data segment, ROM_BIOS_Data, has been placed at the absolute location 40H to overlap with the data area used by the ROM BIOS routines. The question marks prevent DOS from overwriting data whenever Switch is loaded, but they allow Switch to access these ROM BIOS data locations. Open your *Technical Reference* manual to page A-2. The segment definition has been lifted, verbatim, from lines 58-62. EQUIP_FLAG is used by the VIDEO_IO routines. Turn to page A-43 and read through some of the comments about VIDEO_IO.

Now move on to page A-45 and study the procedure VIDEO_IO. This procedure simply initializes registers and does a few tests before JuMPing to one of the sixteen video routines. You can see from lines 3281–8 that these routines use EQUIP_FLAG to determine which display is active; in fact, this is the only reference to EQUIP_FLAG. Switch simply changes the equipment flags to fool VIDEO_IO, then calls upon the SET MODE routine (INT 10H with AH=0) to reinitialize the display.

Now for a few comments on the differences between .exe and .com files. A .com file *must not* have a stack segment; Link will issue a warning, which you can ignore. The other differences are described on pages E-4 and E-5 in the DOS manual. All segment registers are set to the start of the Program Segment Prefix (PSP) block so an INT 20H can be used directly to return to DOS (the CS register must contain the segment of the PSP; see the note on page E-3).

```
;-----------------------------------------------------------------------------;
;          This is an assembler program in '.COM' form. Will not run as .EXE      ;
;                                                                                ;
;  Set up address for the data used by the ROM BIOS.                             ;
;  The equipment flag can be changed to fool the system into thinking that the color/graphics board ;
;  exits instead of the monochrome board.                                        ;
;                                                                                ;
;  <--------|--------> EQUIP_FLAG                                                ;
;                 ^^--display type.                                              ;
;  display type: 1 - color card 40 X 25                                          ;
;                2 - color card 80 X 25                                          ;
;                3 - monochrome display                                          ;
;-----------------------------------------------------------------------------;
ROM_BIOS_DATA     SEGMENT  AT 40H
RS232_BASE        DW       4 DUP(?)      ;Addresses of RS232 adapters
PRINTER_BASE      DW       4 DUP(?)      ; Addresses of printers
EQUIP FLAG        DW       ?             ;Installed hardware.
ROM_BIOS_DATA     ENDS


;-----------------------------------------------------------------------------;
;  This is the start of the executable code.                                    ;
;-----------------------------------------------------------------------------;
CSEG      SEGMENT  PARA     'CODE'
          ASSUME CS:CSEG,DS:ROM_BIOS_DATA
          ORG      100H                  ;Set starting point for a COM file.
SWITCH:   MOV      AX,ROM_BIOS_DATA      ;Set up data segment to point to data
          MOV      DS,AX

          XOR      AH,AH                 ;AH = 0 calls for set-mode function
          MOV      BX,EQUIP_FLAG         ;Get the current equipment flag
          MOV      CX,BX                 ;Make a copy of the flag
          AND      CX,30H                ;Pick off the display information
          XOR      BX,CX                 ;Erase current display information
          OR       BX,10H                ;Set to color display, 40 X 25
          MOV      AL,0                  ;BW 40 X 25 mode
          CMP      CX,30H                ;Was it set to the monochrome display?
          JE       S1                    ;Yes, then set to BW, 40 X 25
          OR       BX,30H                ;No, set to monochrome display
          MOV      AL,7                  ;Monochrome mode
S1:       MOV      EQUIP_FLAG,BX         ;Write flag back to memory
          INT      10H                   ;Make request to BIOS to set display mode

          INT      20H                   ;Return to DOS

CSEG      ENDS

          END      SWITCH
```

Listing 1. ▲

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from page 30

cated on the system board; but they can be accessed in the same manner as any other read/write memory (RAM) in the system.

The adapter contains 16K bytes of memory in the form of eight memory chips. Each of the eight chips contributes one bit to each of the 16,384 bytes available to the buffer. This memory range differs in one respect from the memory on your system board and on most memory expansion boards: the graphics adapter memory is not parity checked.

Although the graphics adapter holds 16,384 bytes of memory, the buffer uses only 16,000 of them. Those 16,000 bytes do not have contiguous addresses; the first 8,000 bytes are in a single block starting at address hexadecimal B8000, and the second 8,000 are in a separate block beginning at hex B8000+2000, or BA000. Between these two blocks is a group of one hundred ninety-two unused addresses.

The dimensions of the screen in medium resolution are 320 pels across by 200 pels up and down. High resolution achieves twice the picture-element density of medium resolution by offering 640 pels across while maintaining 200 in the vertical direction.

Byting Down Hard. Eighty bytes of memory are assigned to each row of pels. This is true in both medium and high resolution. In high resolution, the screen is mapped into 640 x 200 = 128,000 pels. If you multiply the 16,000 available bytes of memory by eight bits per byte, you'll see that leaves exactly one bit for each location on the screen. That means that each high-resolution pel can be either on or off, but no other attributes can be assigned to individual pels. That's why there's no color in high resolution.

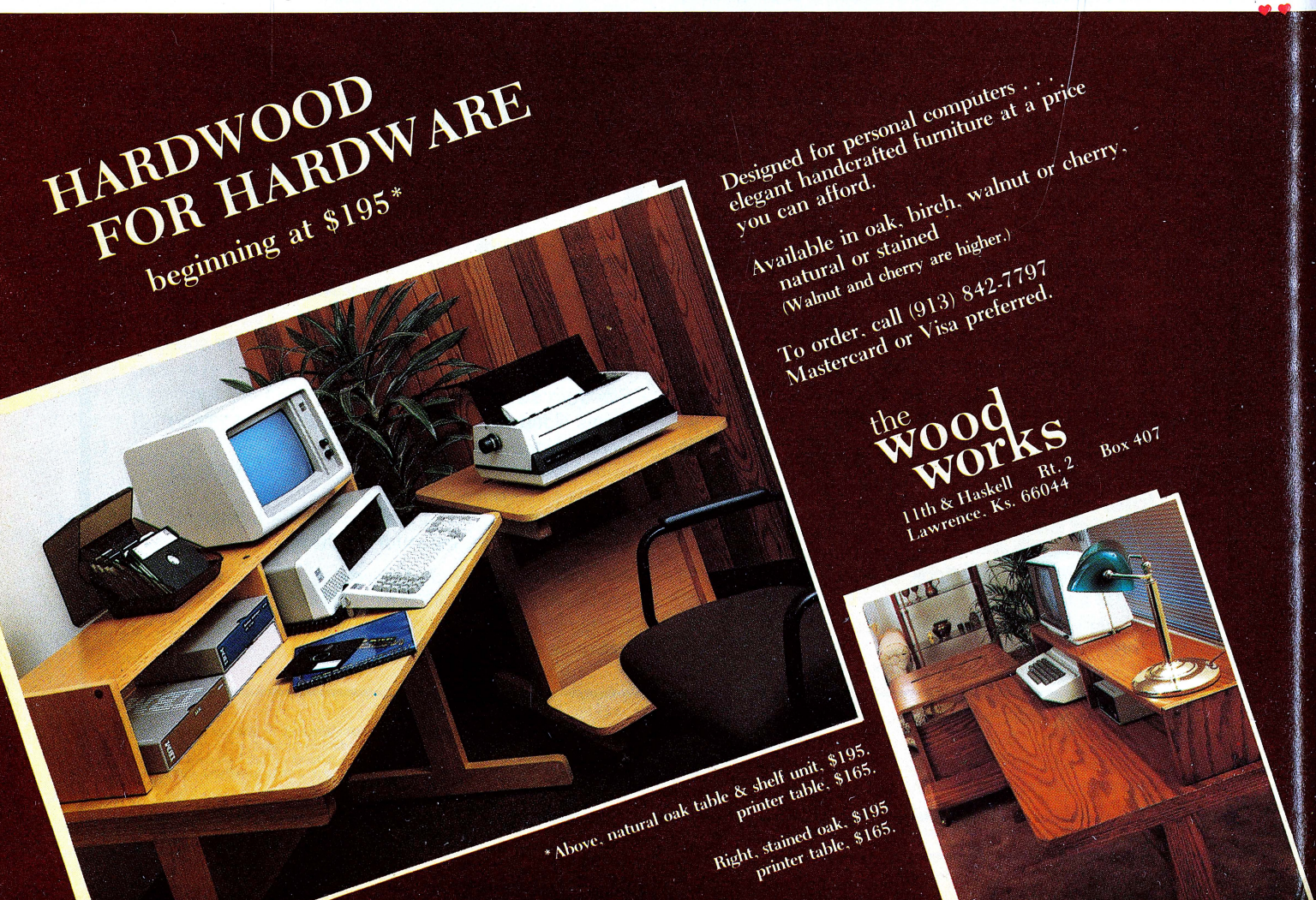
In medium resolution, on the other hand, there are only half as many pels on the screen, so each pel can be assigned two bits of memory. Those two bits can be set in any of four combinations: 00, 01, 10, and 11. When the two bits both hold zeros, the associated pel appears in the background color; the other three combinations, 01, 10, and 11, each represent a distinct foreground color.

The color *palette* determines which colors are represented by these three bit patterns. Two palettes are available, one providing cyan, magenta, and white and the other offering green, red, and brown. The background for either palette may be any of sixteen colors.

Characters may be displayed in graphics mode, although the built-in read-only memory supports only half of the 256 ASCII character sets available in text mode. Each character occupies a region on the screen that's eight pels wide by eight pels high. This is true in both medium and high resolution. In fact, the characters have exactly the same pel structure in both resolutions. Thus medium-resolution and high-resolution characters are of exactly the same height; their widths differ by a factor of two, but most monitors have a switch that causes the medium-resolution characters to be compressed to a more natural width.

Basic Graphics. IBM Basic has several graphics-related statements and functions that provide efficient ways to put information into the display buffer and to read information from the buffer. Those instructions are in addition to the text-related statements and functions, such as *print*, *write*, and *screen*, that may also access the display buffer.

Any of the Basic graphics statements could be simulated by direct access of the display buffer, through *peek* and *poke* instructions. In most cases, however, it's more efficient to use the specialized graphics instructions. A program that relied heavily on *pokes* and *peeks* to control the graphics screen would almost certainly run more slowly than one that did the same thing with the higher-level commands. That's because Basic is an interpreted language, and each *poke* or *peek* would have to be translated separately into machine language.



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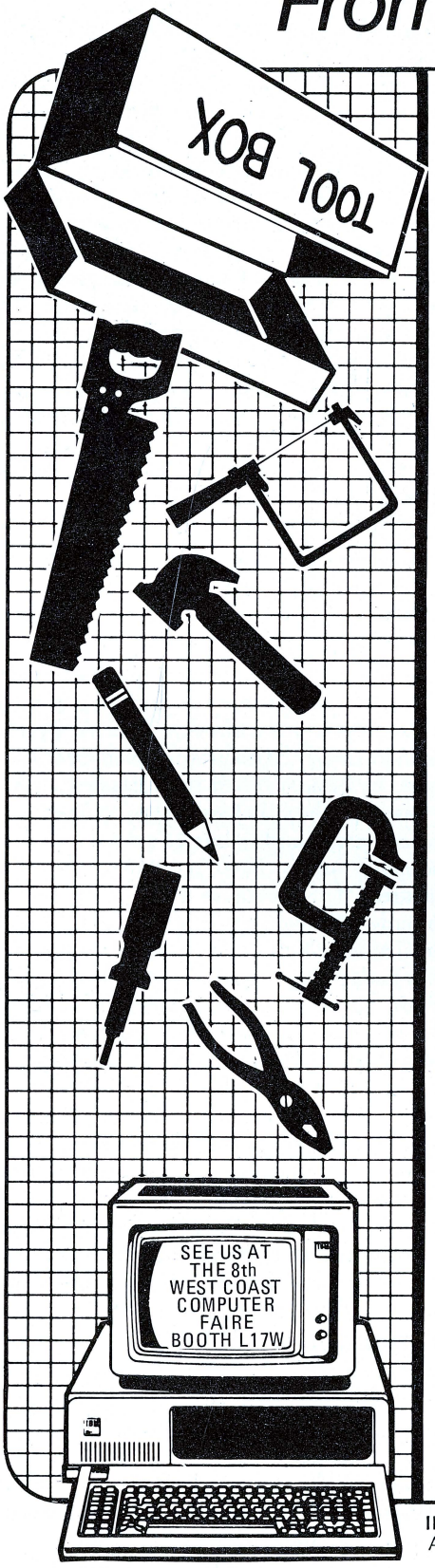

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The graphics instructions allow you to do more of your work at the machine level, which usually means you get much faster execution. Furthermore, the additional Basic program instructions required to simulate the graphics instructions would consume more of the rather limited area of memory available for your program.

Five of the graphics statements and functions are part of Advanced Basic, which is one of the two versions of Basic that come with IBM DOS. The remaining five graphics statements and functions are included in both versions of Basic. Disk Basic, the other version supplied on your DOS disk, takes up about 5K less memory than Advanced Basic, so there's an advantage to using the less powerful Basic if you don't need the advanced features. On a system with 96K or more of memory, however, the advantage virtually disappears, because there's a 64K limitation on Basic's data segment—the portion of memory that Basic can use for work area, program storage, variables, and some required temporary storage.

The graphics statements and functions that exist in both Disk and Advanced Basic are *pset*, *preset*, *point*, *line*, and *color*. The *pset* and *preset* statements set the value of the buffer memory for individual pels. These statements eliminate the need for calculating display buffer addresses from within the Basic program. *Pset* and *preset* differ only in their default values for the pel color.

The *point* function is the inverse of *pset* and *preset*. *Point* returns the color of an individual pel. *Line* can be used to draw a line between two points on the screen or to draw a rectangle whose opposite corners are at specified points. The rectangle may also be filled with a color chosen from the current palette.

The *color* statement is used to specify the background color and palette. The background color is normally selected by specifying a number from 0 to 15. Interesting effects, however, may also be obtained by using the values 16 through 31.

The graphics statements that are available only in Advanced Basic are *circle*, *draw*, *get*, *put*, and *paint*. *Circle* can be used to draw ellipses and slices of elliptical "pies," with specified major and minor axis lengths. The *draw* statement allows you to define a string of elementary instructions that can subsequently be used to create complex screen designs.

Paint causes an area of the screen to be filled with a specified color. The area to be filled is delineated by a boundary color specified in the statement. This is a very powerful instruction; to do the same thing with the simpler instructions *point* and *pset* would take much more time and coding.

The *get* and *put* graphics statements operate on arrays of pel information. They provide a very rapid way to access areas of the screen. The *get* statement fills an array with display buffer information, and *put* transfers the array contents to the display buffer. The buffer contents are mapped directly to the array bit by bit, along with some control information, so it's not easy to interpret the array contents. Nevertheless, *get* and *put* are very effective means of moving images from one place to another on the screen.

The Direct Approach. These high-level graphics instructions provide certainly the easiest means of accessing the display buffer. There are, however, some things that can be done more conveniently by going at the buffer directly, using *poke* and *peek* instructions. The sequel to this article will demonstrate some applications of the direct approach to screen control. For now, we'll round out this article with a brief exploration of the graphics adapter's memory map.

It's a simple task to verify the location of the display buffer. The output of the following Basic program is very convincing:

```
10  SCREEN 1 : CLS
20  DEF SEG=&HB800
30  FOR I=0 TO 7999
40  POKE I,255
50  NEXT
```

Line 10 turns on the medium resolution graphics mode and clears the screen. The *def seg* statement in line 20 sets the Basic "working segment" address to the address of the first byte of the display buffer. The addresses specified in subsequent *peek* and *poke* instructions are treated by Basic as *offsets* from this first address. In other words, when Basic sees the *poke I* instruction in line 40, it adds the value of I to the address named in line 20's *def seg* instruction.

Note that hexadecimal number B800, not B8000, is used as the working segment address. That's because the pc multiplies the *def seg* address by 16 in order to come up with the actual address. Multiplying a hexadecimal number by 16 simply means adding a zero on the right side (just as multiplying a decimal by ten is accomplished by appending a zero), hence to specify a working segment that starts at hex B8000, we issue the instruction *def seg= &HB800.*

This peculiar way of specifying an address has its origins in the addressing scheme used by the pc's 8088 microprocessor.

The last three lines of this program turn on all the bits in the first half of the display buffer. When the program is run, however, it fills every other row of pels on the screen, not just the upper half of the screen. That's because the first eight thousand bytes of the buffer are assigned to the even numbered rows, row 0 through row 198. The last half of the buffer is assigned to the odd numbered rows, 1 through 199—as you can demonstrate for yourself by adding the following lines to the program:

```
60  FOR I=0 TO 7999
70  POKE I+&H2000,255
80  NEXT
```

When the program is run with these additions, all rows of pels are turned on.

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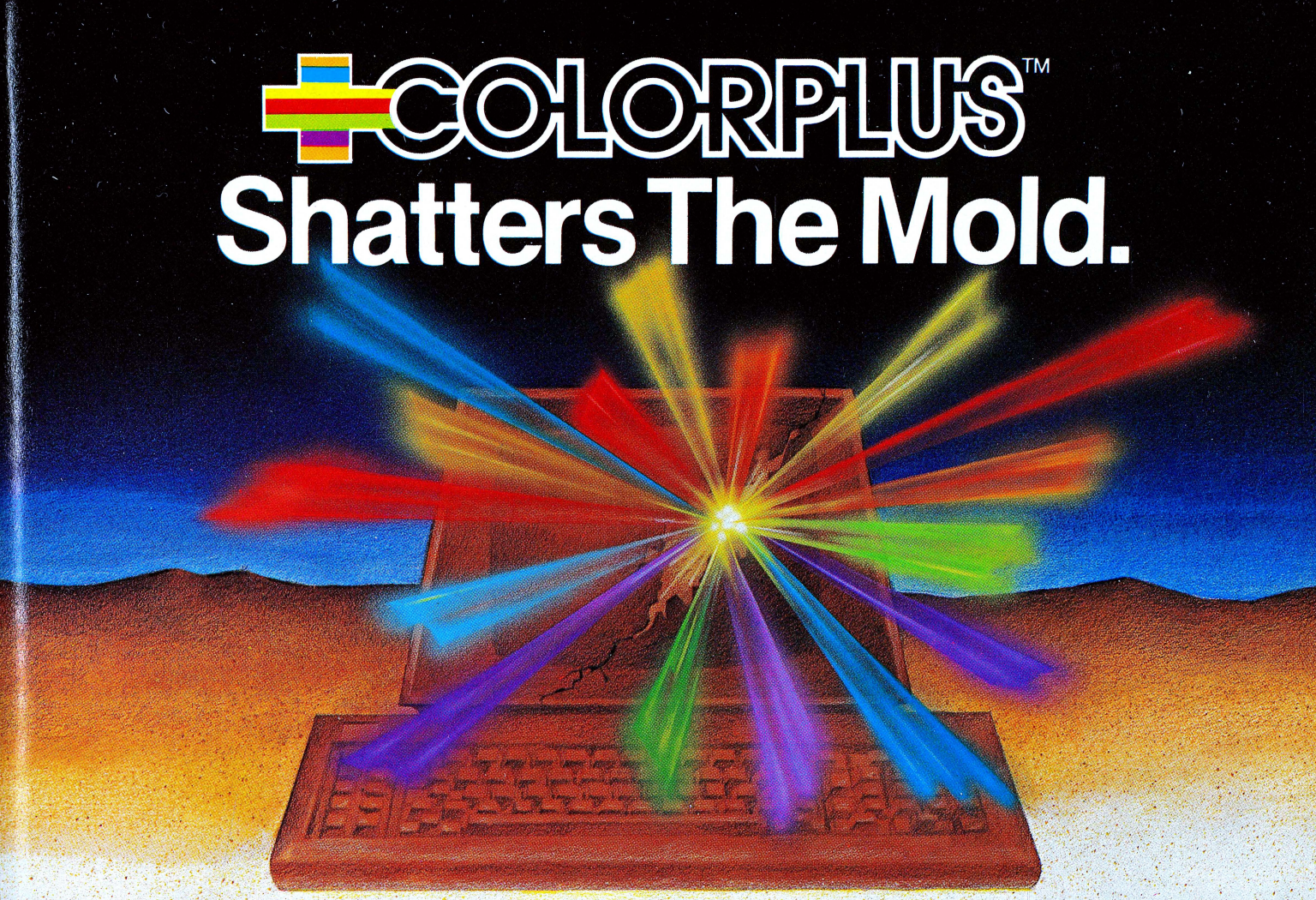

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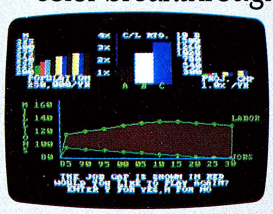

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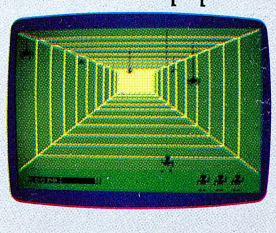

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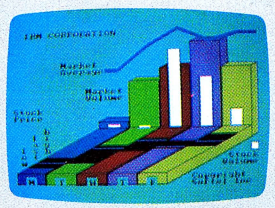

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Winning at Wizardry

At a table in the middle of the room sat five Earthlings, engaged in ritual. The creatures were shouting, and moving tiny idols around on the table. Sheets of paper were waved, bearing dark secrets, for each Earthling kept hidden from the other what was written there.

—E.T. the Extra-Terrestrial and His Adventures on Earth

In 1974, a little company no one had ever heard of published a game called *Dungeons & Dragons*. It was a sorry product—three incomprehensible booklets, with embarrassingly crude drawings of swordsmen, monsters, and scantily clad women.

But the creators of *D&D* had done something right. In their primitive way, they had invented the *role-playing* game, in which a player assumes the identity of another person. Within a few years, they were making millions and trying to cope with competitors who had games with names like *Tunnels & Trolls*, *Villains & Vigilantes*, even *Bunnies & Burrows*. Everyone said someone ought to make it into a computer game.

What Is Wizardry? "Someone" turned out to be a pair of students, Andrew Greenberg (who designed the game) and Robert Woodhead (who did most of the coding). In 1981, their product was released by Sir-tech Software for the Apple II. It quickly went to the bestseller list and stayed there. Early this year, Sir-tech released a Personal Computer version of the game, acknowledging IBM's growing share of the market.

Six people can play *Wizardry* if each controls one character, but the game is usually played by one person who controls all six characters. This makes it hard to experience much role playing, since your personality is divided six ways, but it's not always easy getting together a crowd of people every time you want to play.

The characters live in a romantic, pseudomedieval environment. Their home is called simply the Castle. They do their shopping at Boltac's Trading Post and gather for expeditions at Gilgamesh's Tavern. Afterward, they rest up at the Adventurer's Inn. If someone is dead, turned to stone, or under some other affliction, the other characters bring him to the Temple of Cant, where the priests are usually able to help him.

---

by Forrest Johnson

Illustration by Kevin McKeon

Profession	Alignment	Fighting Ability	Armor Class	Hit Points	Magic Ability	Special Ability
Fighter	Any	Very Good	Very Good	Very Good	None	None
Lord	G	Very Good	Very Good	Very Good	Poor	Weak Dispel
Samurai	G, N	Excellent	Very Good	Good	Poor	None
Ninja	E	Excellent	Very Good	Fair	None	Critical Hit
Priest	G, E	Good	Good	Good	Very Good	Dispel
Mage	Any	Poor	Very Poor	Poor	Very Good	None
Bishop	G, E	Fair	Poor	Fair	Fair	Weak Dispel/ Identifies Items
Thief	N, E	Fair	Fair	Fair	None	Inspects Chests/ Disarms Traps

Character Types

The characters have professions like hairdresser, accountant, and shoe salesman . . . just kidding! Their professions are fighter, priest, bishop, mage, thief, lord, samurai, and ninja; and each has its own special abilities. Characters are ranked by level in their professions. Their abilities are also influenced by their *characteristics*. There are six—strength, I.Q., piety, vitality, agility, and luck—and every character has a numerical rating in each. To help things along, characters must have certain characteristics in order to belong to certain professions. No feeble fighters or stupid mages allowed! (Stupid fighters and feeble mages are okay.) The requirements also rule out the creation of a beginning character who is a lord, samurai, or ninja. However, experienced characters can change professions as their characteristics increase.

Each character belongs to a race, such as human, elf, dwarf, gnome, or halfling. This is an equal opportunity game; the differences between races are not very important.

There is a little forced role-playing in the game. This takes the form of *alignment*. A character's alignment is good, evil, or neutral, and this has to do with his profession—there is no such thing as good thief or an evil samurai. Also, characters of opposite alignment may not join the same expedition. (Neutrals, of course, can belong to any party.) Occasionally, an expedition encounters a friendly group of monsters. There are friendly bushwackers, friendly dragons, even friendly slimes! Evil characters are expected to attack the friendly monsters, and good characters are expected to leave peacefully.

Magic plays an important part in *Wizardry*. There are two kinds of magic—priest and mage—and many different spells for each. In general, priest spells are used to defend or heal the party, and mage spells are used to attack. Lords get a few priest spells, samurai a few mage spells, bishops a few of each. As characters increase in experience, the number and power of spells they can use increase proportionally. When characters change profession, they retain a certain number of the spells learned in their old professions.

Two other factors to bear in mind: *armor class*, an index of a character's vulnerability to physical attack, and *hit points*, a gross measure of ability to absorb damage. Armor class starts at ten and goes down. The lower the armor class, the better. Some professions are limited in their ability to wear armor. Ninjas are a bit unusual, in that their armor class declines with experience (they get harder to hit) when they aren't wearing any armor. (However, they are generally better off wearing armor than relying on their natural armor class.) When your armor fails (and it inevitably does), you take damage, which is subtracted from your total of hit points. Hit points can be restored by magic or simply by resting at the Adventurer's Inn.

The Professions. Before you can play the game successfully, an understanding of the different professions and how they relate to each other is called for. The table on this page summarizes the strengths and weaknesses inherent in the various professions. (Of course, this is only a rough index; professional abilities vary a lot from individual to individual.)

Fighters are straightforward people. They relate to monsters by splitting their skulls with sharp instruments. That's about all they do, but they do it well. Any successful party is likely to include a couple of fighters.

Lords are like fighters, but they have some priestly abilities as well. That really isn't an unequivocal advantage, though, because to create a lord you must change the class of an experienced character; in the process, the experienced character loses a lot of points and starts again at the first level of experience. Generally, it is better to have an experienced fighter than a novice lord. On the other hand, there are a few magic items that can be used only by lords.

Samurai, like lords, can only be created from experienced characters. Again, it is usually better to have an experienced fighter, but there are some magic items useful only to samurai.

Ninjas do not know any magic, but they do have one special ability—the *critical hit*. Every time a ninja strikes a monster, there is a percentage chance of achieving a critical hit that kills the creature with a single blow. Ninjas can also function as thieves.

Priests are fairly good in combat. More important are their spells and their ability to dispel undead monsters. (The priest says holy words and the vampire or whatever goes back to the dismal pit it came from.) A priest is an indispensable member of most expeditions.

Mages are lousy in physical combat, but their spells can be devastating. An experienced mage can vaporize a dozen threatening monsters in a flash. Most parties bring along a mage.

Bishops are not just high-ranking priests. They are a bastard cross between priest and mage, and can be created with beginning characters. Though bishops have some of the abilities of a priest and mage, they are not really as good as either. Their spells are modest in power. They cannot fight as well as priests, and their dispel ability is weaker. However, they do have one unique ability.

Scattered among the hoards collected by monsters are hundreds of magical items. When you find a magic item, you may have trouble telling exactly what it does. For example, if you find a sword, you may not be able to tell whether it is better than an ordinary blade or whether it is cursed. Boltac the merchant can identify items for a price, but a bishop, if you have one, can try to do it for free. (As you might expect, an experienced bishop has a better chance of success.) The danger is that your bishop may pick up a cursed item and not be able to put it down again.

Thieves are almost as worthless as the name implies. They have no magic and no great prowess in battle. They do have one important function. Some monsters keep their hoards in chests with traps. Any character can inspect a chest and try to disarm the trap, but thieves have the best chance of success.

Putting Together a Party. The success of an expedition depends on the diverse abilities of its six members. You can have fewer than six characters if you want, but there is rarely any advantage in doing so.

The first decision to make in putting together a party is choosing the alignment. This is not so much a question of morality as of strategy. At least one party member, the priest, must be either good or evil. If too many characters are good, you may find yourself accumulating a lot of interesting magic items that can be used only by evil characters. If you choose evil, it will create problems if you later

want to develop a lord. Perhaps the best approach is to keep a stable of predominantly neutral characters, and mix good or evil into the party as necessary.

The order of the party is important. Only the first three members can attack in physical combat, or be attacked. The second rank of characters can only cast spells. Obviously, you want your fighters in front.

A party put together by a novice might look like this:

1. Fighter
2. Fighter
3. Priest
4. Thief
5. Bishop
6. Mage

While this kind of party can do almost anything, it can't really do anything *well*. The priest is in an awkward place. He isn't as good in combat as a real fighter, and he can't fight and use magic at the same time. If a monster knocks out the priest, the whole party is in trouble because there is no one else who can restore him. Also, the bishop is not really pulling his weight. The magic he knows is not that much use in a crisis. He can identify magic items on the spot, but it is more efficient to leave him on the surface and let the rest of the party haul stuff back at the end of each adventure for him to look at.

A party put together by an experienced player is more likely to look like this:

1. Fighter
2. Fighter
3. Fighter
4. Priest
5. Thief
6. Mage

There are situations where magic can't save you. Having three good fighters in the front rank can be comforting. The priest is in the second rank, out of harm's way, but will automatically move to the first rank if one of the fighters is disabled. The remaining weak sister in this organization is the thief, who is virtually useless in combat. If it were not for the thief's special role, you might as well have left him on the surface.

If your people are evil, wimpy number five is not really a problem. Develop a ninja for the first rank and replace your thief with a mage or bishop.

An apparent solution to the thief problem (if your people are not evil) is to equip your thief with magic items that can be used from the second rank. Unfortunately, most magic items can be used only a limited number of times, and your thief can carry only a few of them at once. While the thief's magic items might help you out of a bad situation, they do not really solve the problem.

If you prefer the good alignment (and a lot of people do), the only solution to the thief problem is to create a character specifically for the slot. Start with a neutral, halfling mage and build him up for a while. Then convert him to a thief, and build him up some more. The result is a character who can cast spells and still operate as a thief. Of course, he won't be a topnotch mage *or* thief, but he will be able to get along with a little help from the other characters.

Creating Characters. Once you have an idea what you want your party to look like, you can start filling the individual positions. This means going to a routine called the Training Grounds. Each character must be given a name and a password. It helps if a name suggests the character's profession, for example "Merlin" for a mage or "Lancelot" for a fighter. Take your names from the Bible, from Tolkien, from Monty Python, or wherever you like. Role playing is more fun if everyone comes from the same mythos.

If you are playing by yourself, you don't need a password; just hit enter when you're asked for one. Even if you are playing with someone else, it is still more convenient to trust people instead of messing with passwords. There is no password that can protect your disk from scissors, so don't tamper with other people's characters!

Your character's race is not really as important as it may seem. If you are in doubt what race to choose, go with a human. Humans have decent characteristics in everything but piety, so they are a good choice for everything but priest or bishop, and they can even fill those slots if you want.

In addition to the initial points allowed for each race, you get a number of points that can be distributed freely among the characteristics. Usually, the distributable points number between seven and ten. For about one character in ten, you get a bonus of ten distributable points. A persistent player will create characters and delete them until he has a complete set of bonus characters. A real fanatic will hold out for the twenty-point bonus that comes about one time in a hundred.

Be choosy when distributing points. Unless you are planning to convert that fighter into a samurai, she doesn't need much intelligence. Don't give her any!

A fighter needs strength, but don't give her too much of that either. You could give her a big advantage by starting the game with eighteen strength, but the other characteristics would suffer. And when your fighter went up in experience, the points she would ordinarily add to strength would be wasted, since no characteristic can rise above eighteen. Better to give her some extra agility and vitality. Everyone needs that.

Having created characters, you go to Boltac's to equip them. This is always difficult the first time, since you don't have much money. The best way is to pool your characters' money and equip the fighters first. They need the most expensive armor and weapons. ("Most expensive" in this game usually means "best." Some exceptions will become obvious as you begin collecting magical equipment, but you needn't worry about exceptions in the beginning.)

Some people create characters, strip them of their gold, and then delete them. But the game is more fun if you play it without resorting to that kind of trickery.

Resist the temptation to weigh your characters down with lots of miscellaneous equipment—scrolls, extra weapons, and what have

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you. That would interfere with their ability to handle the items they find in the dungeon. Never equip a character with an item until it has been properly identified. To do so is to invite disaster.

Exploring the Proving Grounds. Many scenarios are planned for *Wizardry*, but only one is available right now. The "Proving Grounds" is a monster-filled dungeon of ten levels on the master disk. Each level in the dungeon is a separate twenty-by-twenty maze. The place has a lot of funny architecture—stairs, elevators, dark rooms, one-way doors, pits, magic drainers, teleporters, rotating floors, and so on. It is possible to explore the first couple of levels without careful mapping, but below that, graph paper is essential.

When you enter the dungeon, a 3-D view of the corridor fills a corner of the screen. When you come upon a group of monsters, a picture is superimposed on that part of the display. In addition, you get a text description of any unusual features you encounter.

The key to surviving the dungeon is caution. Don't go far from the entrance until your characters have reached the second level of experience. Don't risk the stairs until they are all fourth or fifth level. (And, even so, invest in some potions against poison, and make sure your priest can cure paralysis.) Don't play around with the elevator until your party is a lot stronger than that, unless you want your characters to become dragon food!

As you go deeper, use elevators to keep down your dungeon time. It is better to have many short adventures than a few long ones. Resist the impulse to look at "one more room." Head back before your magic gets too low.

Explore carefully. Check out every corner of the level you are on before proceeding to the next one. Secret doors will limit your exploration at first, but soon you will be able to use enough light spells to eliminate that problem. Hidden in various out-of-the-way places are keys and other small objects that give admittance to certain areas of the dungeon. If you try to enter one of these areas without the key, your party will all pass out—or worse.

Once you have an area mapped, you will be able to move through it very quickly. Take advantage of your machine's fifteen-keystroke buffer by entering commands before you are prompted. This will speed up the game. But use a little foresight. Depending on the context, the keystroke "F" will move you forward one step, make you fight a group of friendly monsters, or drop you suddenly to the ninth level of the dungeon.

Don't go rushing down to the next level just because you have finished mapping this one. If you don't feel confident about tackling the next level, try to build up some more experience before proceeding. There are a number of ways you can build up experience without much risk. For example, there is a certain room on the first level where you always encounter Murphy's Ghost. This phantom has a lot of hit points but can't do much damage. He's worth a bundle of experience, and you can kill him over and over. Similarly, there is an alarm in a certain corridor on the fourth level that causes monsters to appear in the adjacent rooms. A powerful party can trip that alarm again and again, thereby getting lots of opportunities to gain experience.

It's not readily apparent, but there are two kinds of monsters. Room monsters are encountered immediately on passing through a door, and they often have chests. Every time you hit a key there's about a one percent chance you'll run into a wandering monster. They never have chests. Since magic items are found almost exclusively in chests, it is much more profitable to fight room monsters.

When you use an elevator, all the room monsters on the level you're entering reset. In other words, by using an elevator, you can clean out the same rooms over and over. Having mapped a level, you can draw a nice circle of rooms that includes the one containing the elevator. Go down, make the circle, come up, go directly back down, and so on. Keep track of the monsters you encounter. They start as orcs, skeletons, and slimes, but by the time you reach the bottom of the dungeon they have escalated to poison giants, vampires, and greater demons. Try to get to know each kind, how many hits it can take, how spells affect it, whether it can be dispelled, what attacks it can make, how it is identified on the screen. "STRANGE ANIMALS" with one picture means trolls; with another, wyverns. The difference is important.

When you find a chest, have your thief inspect it. The screen will flash "ALARM," "POISON NEEDLE," "GAS BOMB," or something like that. Hit "D" to disarm the trap. The computer will ask you who is disarming (your thief) and what trap you are attempting to disarm (whichever one it told you). Spelling is important. Sometimes you will get the response "DISARM FAILED!" That means you identified the trap correctly but the thief failed to open it. Try again. Occasionally, the computer will flash your options on the screen again, as if you never tried to disarm the trap at all. That means that your thief misidentified the trap. Have your priest cast the trap detection spell and try again. (Usually, though, you don't get a second chance if you misidentify a trap.)

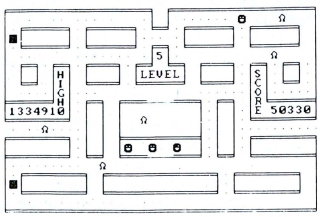
Never just open a chest. Always try to disarm it, even if you don't think it's trapped. This will give you some protection when your thief misses seeing a trap.

Killing Werdna. At the bottom of the maze is Werdna (read it backward), an evil mage who has stolen a precious amulet. Your long-range goal is to kill Werdna and recover the amulet, but he has a coterie of vampires with him and has positioned an assortment of powerful monsters in the way. Even if you manage to kill Werdna, the game isn't quite over. You still have to get to the surface, and if you go directly you may find your equipment has been confiscated by the local nobility. (Ungrateful!) Experience will teach you how to get to Werdna, kill him, and return intact to the surface.

Then you will be ready for the next scenario of *Wizardry*! ▲

CHOMPS **$29.95**

CHOMPS is an absolute must for every game enthusiast. The game is superb for its animation, sound, speed, playability, and excitement. You maneuver your CHOMPS around a maze scoring points as you gather dots, catch monsters or collect prizes. Most of the time you are being chased by monsters, but eating the energy cells will make you mightier than them for a short period of time.



The game is loaded with features:

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- ★ The sounds are fantastic, and can optionally be turned off.
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beginners' corner

by Craig Stinson

The last few episodes in this series have dealt with the subject of high-level programming languages. We've looked at the three versions of Basic commonly used on the Personal Computer. One of these, Cassette Basic, is standard equipment; it's built into the permanent memory of the pc. The others, Disk Basic and Advanced Basic, are extensions of Cassette Basic and are standard equipment for anyone who uses PC-DOS.

We've seen that programs written in high-level languages have to be converted to machine language before your computer can run them. Compilers and interpreters are alternative means of effecting this translation. Each has its advantages and disadvantages; translation by compiler generally results in speedier program execution at the expense of interactivity during program development.

Pseudo-Code and Pseudo-Machines. It's worth mentioning here that one popular programming language, UCSD Pascal, gets handled by both a compiler and an interpreter on its way to becoming machine code. When you finish writing a program in UCSD Pascal, you first compile it into something called *p-code* (the *p* stands for *pseudo*). Later, when you run the program, this p-code undergoes a second translation at the hands of a p-code interpreter. The UCSD Pascal compiler, the p-code interpreter, a host of other programming tools, and a disk operating system together make up a package called the UCSD p-System, which is manufactured by SofTech Microsystems and (in its pc form) marketed by IBM.

One of the virtues of high-level languages, you may recall, is that they allow you to program complex series of machine actions by means of simple statements. Basic's *print*, for example, or Pascal's *writeln* usually results on translation to machine language in a number of individual machine instructions; exactly which instructions depends on the context in which the high-level command is used.

The UCSD Pascal compiler digests the programmer's high-level *source* code into individual machine steps, but the code it generates is not a code your pc understands. Instead, the compiler produces machine-level code for a hypothetical computer called a p-machine (actually, that machine does now exist and is available from a company called Western Digital; when the UCSD system was designed, however, the p-machine was a hypothetical entity).

Because p-code is an almost-machine-level language, the process of interpreting it is a little less time-consuming than the process of interpreting equivalent instructions in Basic. Hence, you can usually expect swifter performance from a UCSD Pascal program than from a similar program in Basic. Nevertheless, this method of translation has the drawback common to all interpretive approaches—the fact that repetitive sections of source code have to be repetitively translated.

UCSD Pascal employs this curious two-step translation scheme, not for the sake of execution speed but because the scheme has allowed the system's designers to create a single "front end" programming environment that can be used, with only minor modifications, on a great many different computers. That is, the compilation of Pascal source code into p-code is essentially the same process, whether the source code was created on a pc, an Apple, or an IBM DisplayWriter.

The importance of that fact to programmers is that many programs written in UCSD Pascal can be transported from one kind of computer to another with (relatively) little effort, even if the machines in question are built around very different processing hardware. Easy portability is obviously a

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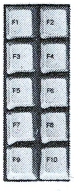

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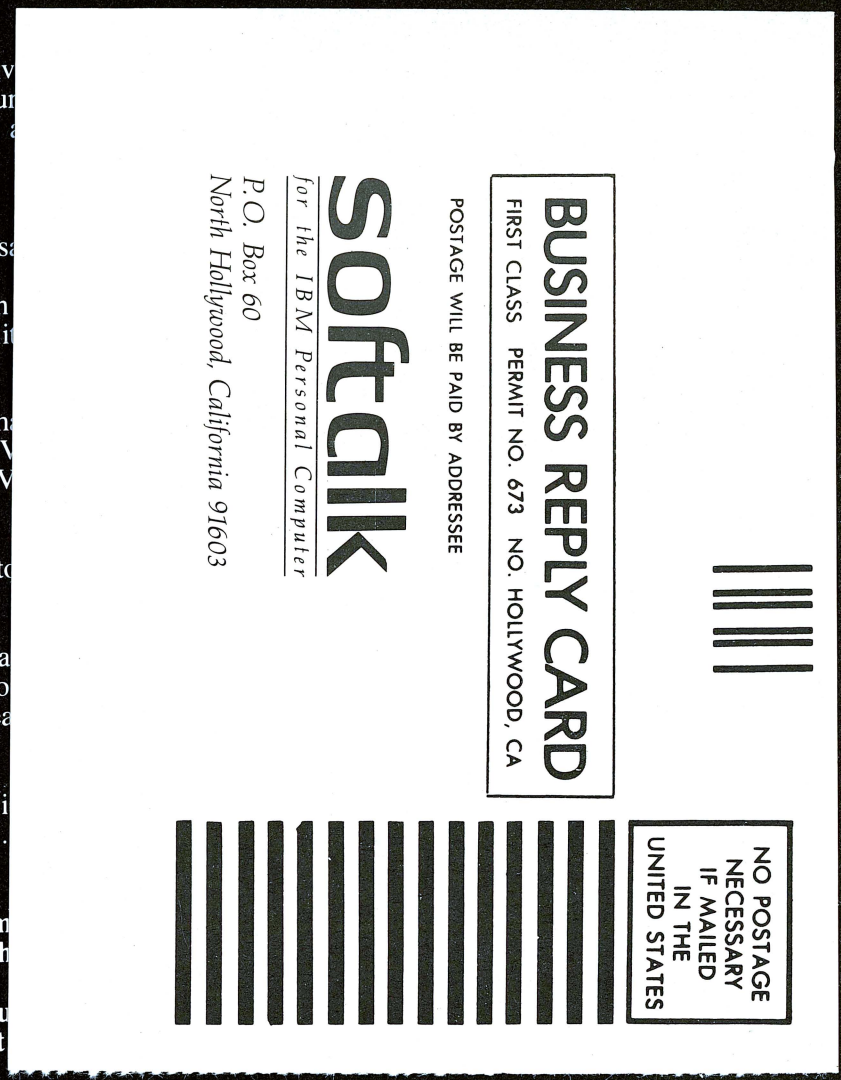

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beginners' corner

by Craig Stinson

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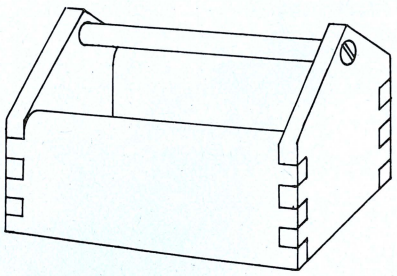

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boon to software producers, but it's clearly also a value to you as an end user, because it means that software originally written for other machines, such as the Apple, can more readily be made to run on your pc. *MBA*, *Wizardry*, and IBM's recently released *PFS* programs are among the more conspicuous examples of programs written in UCSD Pascal.

Ones and Zeros. Having dealt at least superficially with the subject of high-level languages, it's time now to descend for a closer look at what goes on inside when you run your computer. We've been glibly tossing about concepts like *machine code* and *machine language*; let's see now if we can get a handle on what these terms mean.

What do computers really understand?

In a sense, of course, they understand *nothing*, since they only do what they're told to do. But they have the capacity to *distinguish* between two fundamental kinds of signals, and this capacity allows them to store and manipulate information. Before we can talk about machine code, we have to deal in general with the matter of how computers store information.

Think of the two kinds of signals as zero and one. They could as easily be called on and off or high and low, but calling them one and zero will facilitate your understanding of how the computer stores numeric information.

There is a system of counting, called *binary*, that works just like the counting method with which you're already familiar, except that it employs only two symbols—0 and 1—instead of the ten digits you know and love. In binary notation the quantity *zero* is symbolized *0*, the quantity *one* is written *1*, but the next number, the quantity *two*, is written *10*. It's still two, of course, and it's pronounced the same way it always has been, but it's written differently. Three in binary is written *11*, four is *100*, five is *101*, and so on.

To visualize the way this notational system works, imagine that the cylinders on your car's odometer have only the symbols 0 and 1 but that the odometer works the same way it always has. Each time a cylinder moves past its *1* position, it causes the cylinder to its left (or, rather, to your left as you face this counter) to move. If the neighboring cylinder happens to be showing a 1, it bumps *its* neighbor—and so on.

If this odometer has the customary five cylinders with which to indicate whole numbers, then you'll only be able to go sixteen miles before the system resets itself to zeros. But in principle (that is, given a large enough supply of cylinders), you can mark your milestones as accurately with this binary odometer as with your ordinary *decimal* one.

This hypothetical device can count fractional quantities as well as whole numbers. However, the first cylinder to the right of the "binary" point, since it has only two symbols at its disposal, must divide the mile into halves—not tenths. The cylinder to its right (if one exists) counts halves of halves, or quarters, and so on.

Computers store numbers by means of binary notation instead of the decimal notation humans customarily use. The reason they do so is easy enough to understand; binary counting simplifies the electronic circuitry. Storing numeric information by means of two-position counters allows the computer to use components that are—conceptually, if not mechanically—about as simple as on-off switches. The drawback to binary counting is that you need a lot of counters to write large numbers. But the counters that your computer uses are exceedingly small, and, as you'll soon see, your machine has a rather impressive supply of them.

As a footnote to the last couple of paragraphs, we should mention that there are some differences between what you might call a pure or simple binary counting system, such as the one used by our hypothetical binary odometer, and the method of counting used in computers. Since your pc doesn't have minus signs or decimal points (or, for that matter, "binary" points) to work with, but in fact has *only* two kinds of signals at its disposal, it has to do a little finagling in order to represent negative and fractional numbers. And since its supply of counters, while large, is nevertheless finite, its approach to the storage of very large numbers also deviates somewhat from a straightforward binary scheme.

It's not the least bit crucial that you understand *exactly* how the computer stores numbers, but it's worthwhile understanding the principle of binary counting and why this kind of numbering system is used in computers.

Numbers into Letters. So much for numbers. What about letters?

Letters and punctuation symbols first get translated into numbers; then they're stored in the same way as regular numeric information. A code called ASCII (short for American Standard Code for Information Interchange and pronounced *ass-key*) takes care of the translation into numbers.

Each capital letter, each lower-case letter, and each punctuation symbol is encoded by ASCII into its own unique number. The code—which also provides for certain *control characters* used chiefly as commands to printers, terminals, and other physical devices—arranges the alphabet in ascending numeric order. Capital A, for example, is 65; capital B is 66, and so on; the lower-case letters come after the capitals. This organization of the code has the virtue of facilitating alphabetization on the computer; each letter of the alphabet has its own

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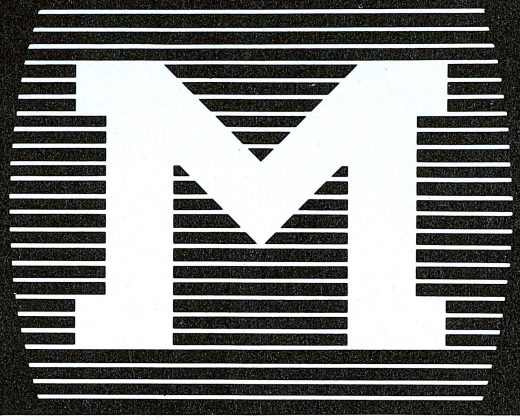

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numeric rank, and it's a relatively trivial task for the computer to compare words and set them in their proper numeric order.

ASCII is one of the few examples of standardization in the computer world. Just about all computers recognize it. It's because this code is in nearly universal use that you can communicate information from one kind of computer to antoher, over phone lines or by direct cable hookup. The primary exception to the universal use of ASCII is the IBM mainframe computer; this beast uses a different coding system, called EBCDIC (pronounced *epsidick*, with the stress on the first syllable).

Now that you have some idea how the computer breaks information down into ones and zeros, consider the quantity of ones and zeros that it must at any moment have at its disposal.

Let's say, for the sake of argument, that you've got your word-processing program running and you've typed a fifteen-hundred-word document. Some half a million units of information—each of which may be a one or a zero—are required to keep this juggling act in motion. Some of this information consists of ASCII-encoded numbers that represent your document. Some of it provides the functioning of your word processor; some of it is taken up by the Disk Operating System, and the remainder of it is required for the maintenance of more fundamental computer operations—such as the operation of your display screen, the channeling of information coming into the system by way of your keyboard, and so on. The questions before us are: Where does all this information reside and how does the computer navigate so oceanic an array?

Leaving disk drives aside for the moment (because they're essentially external to the system), the computer keeps its information in three places: in random-access memory (RAM), in read-only memory (ROM), and within the microprocessor chip. The microprocessor chip holds a relatively minute amount of information, so we'll focus our attention first on RAM and ROM.

Once you've turned the power on, RAM and ROM are, for all intents and purposes, a single domain of memory. To the microprocessor they look the same; the only difference between the two types of memory is that, when you turn your machine off, ROM's information remains, while RAM's turns to mush.

Bits and Bytes. The individual ones and zeros in your computer's memory are called *bits* (the word *bit* is a contraction of *bi*nary digi*t*). When the computer moves information in and out of memory, it does so in units of eight bits, which are said to comprise a *byte*.

To find its way around in memory, the computer assigns each byte a numerical address. On the pc the addresses of individual bytes range in number from 0 to 1,048,575. Chances are you don't actually have that many bytes of memory in your system, but the pc's 8088 microprocessor chip is, in theory, capable of negotiating that many separate memory locations.

One million forty-eight thousand five hundred seventy-six bytes of memory, incidentally, are said to comprise a *megabyte*; so your pc has an *addressing range* of one megabyte. The reason a megabyte isn't a plain million is that one million is a clumsy number in the binary system; 1,048,576, on the other hand, is a nice round binary figure—a 1 followed by twenty zeros.

If you take the lid off your pc and peer inside, near the front of the machine on the left side as you face it, you'll find one or more rows of nine rectangular black objects. These are RAM chips. When the computer fetches a byte of information from random-access memory, it reads one bit from each of eight chips located within a single row. The ninth chip in each row (the one on your left) serves a special function, called *parity checking*; this is a method of error detection, about which we'll have more to say at another time.

Each chip holds 16,384 bits—a quantity usually abbreviated as 16K. A *kilobyte* is 1,024 bytes; again, the deviation from the standard meaning of the metric prefix has to do with binary counting.

Your computer's main circuit board, sometimes called the *system board* or the *motherboard*, has room for 64K of RAM. This 64K is assigned the address range 0 through 65,535.

Directly behind the RAM chips on your system board is a row of larger memory chips; these are the ROMs. The pc's 48K of read-only memory is assigned to the other end of the address spectrum—from 999,424 on up.

Your system also has memory in one other place, between address 65,536 and address 999,424—on its video display adapter. The color/graphics adapter and the monochrome display adapter each come with their own 16K. The mono board's memory starts at address 720,896, while the graphics board's starts a little higher, at 753,664. Finally, if you've bought one or more memory expansion boards for your pc, you have some additional RAM that's probably addressed to the area starting at 65,536 (most memory boards allow you to specify any starting address you wish, but it's customary to use the address space that's contiguous with the 64K block of RAM on your system board).

We've taken a first look now at the form in which information is represented in your computer and the physical locations where it's held. But none of this discussion sheds any light on the question of how the computer uses its information—how it knows what to do with all those ones and zeros. We'll pursue that matter next time. ▲

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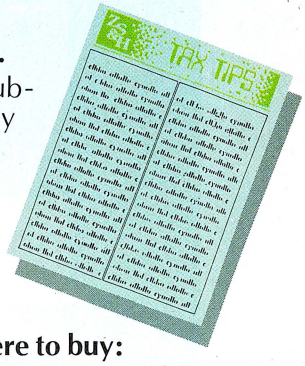

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ANNOUNCING PC '83, THE INTERNATIONAL CONFERENCE AND EXPOSITION FOR PC USERS.

In the last few months, *thousands* of exciting new products have become available to make your IBM Personal Computer work in hundreds of innovative, landmark applications. By adding the right software, plug-in cards, peripherals and accessories, you can make your PC more productive and useful than you ever dreamed possible.

And now there's finally a way to learn about and try out all of these products: PC '83, the first international event *exclusively* for PC users.

THE LARGEST EVER

The exposition portion of PC '83 is the largest gathering of PC-compatible products ever held. You'll find, under one roof, more than 400 exhibits of software for business, professional, home, personal and education applications; plug-in cards for memory expansion, telecommunications, speech and many other functions; hundreds of peripherals, including printers, networking systems and innovative new storage devices; plus dozens of publications, books and invaluable support services. PC '83 brings together the *entire* PC world.

RELIABLE AND COST-EFFECTIVE

Think about the different vehicles available for buying software and add-ons for your PC. You can shop at local computer stores, but they usually have a very limited selection of products and a less-than-expert staff. You can buy through mail order—and take some big risks if you get products that don't work or don't do what you expected.

At PC '83 you have the best of all worlds. You can see *all* the different PC-compatible products in one location at one time. You can talk with factory experts rather than just local salespeople. You can 'test drive' each product and decide if it's right for you. And when you find what you're looking for, you can buy it right on the spot.

Best of all, you'll save hundreds—even thousands—of dollars at PC '83. Most of the products shown at PC '83 are sold at special show prices, so you won't have to look hard to find incredible values. And because PC '83 will help you make more informed purchase decisions, you'll end up with products that are better suited to your applications.

A REMARKABLE CONFERENCE PROGRAM

The conference program at PC '83 isn't just a warmed-over, pared-down version of other computer conferences. The seminars, workshops and forums at PC '83 are the result of months of research and planning targeted toward one specific goal: helping you get absolutely the most out of your IBM Personal Computer.

The program features world-renowned PC authorities speaking at over 100 educational sessions. Seminars provide an in-depth, understandable look at a broad range of PC uses in business, home and education. Seminars emphasize 'how to,' telling you specifically what you need to know—in non-technical language—to use the PC in dozens of different applications.

Forums present an inside look at what's happening in the PC-compatible industry and what new developments you can expect in the next few years.

Software and Hardware Spotlights are a PC '83 exclusive. These workshops address one of the biggest problems that virtually all computer users face: how to decide which software and hardware packages are best for your applications. Each Spotlight provides a detailed discussion and demonstration (with large-screen television) of a group of products, covering their features, capabilities *and* limitations. Experts are on hand at each of these sessions to answer all your questions.

EASY ON YOUR FEET

We've thought of a lot of details to make your visit to PC '83 just a little more pleasant. As with all of our events, the show is fully carpeted, so your feet won't give out before you've seen all the exhibits.

Our unique Conference and Exhibits Guide helps you quickly find the exhibits and educational sessions you want to attend—even if you can't remember their names. And the Guide is provided free of charge to all attendees.

If you're traveling some distance to attend PC '83, we'll arrange a discounted hotel room near the show site through the PC '83 Housing Bureau. On request, we will also provide information on things to do, places to visit and where to eat in San Francisco and Boston—to make your stay in these grand cities a memorable and relaxing one.

A TOTAL SUPPORT SERVICE

Let's face it, getting support for your PC is tough. The PC magazines, newsletters, user groups and retailers are certainly helpful. But there are so many different products, services and things to learn about for your PC, what you really need is *one* event that brings everything together in one place in a well-organized format.

PC '83 does it all. It showcases all the PC-compatibles under one roof. It has a complete and comprehensive program of seminars, forums and product workshops. And it's produced with the quality and professionalism you've come to expect from Northeast Expositions.

So if you do anything with the IBM Personal Computer or if you're considering buying one, be sure to put PC '83 in your calendar right away.

Your PC will certainly appreciate it.

PC '83

SAN FRANCISCO:
Friday-Sunday, June 17-19, 1983, Brooks Hall/Civic Center, 10:30 AM-5:30 PM daily

BOSTON:
Saturday-Monday, October 8-10, 1983, (Columbus Day weekend), Bayside Exposition Center, 10:30 AM-5:30 PM daily

PC '83 Show & Conference Preregistration Request

1. Complete this form (or a facsimile) and mail it with a check payable to PC '83, to National Computer Shows, 826 Boylston Street, Chestnut Hill, Mass. 02167. Use a separate form for each person preregistering.

2. All preregistration requests must be received no later than 7 days prior to the event. Telephone or credit card orders cannot be accommodated.

3. For one-day-only registrations, indicate the specific day you will attend the event.

4. Badges and tickets will either be mailed back or held for pick-up at the Show's preregistration desk. In either case the preregistrant will be notified by mail of our receipt of their order. All preregistrants will receive the Schedule of Conferences Program, a list of exhibitors and hotel reservation forms, prior to the event.

5. It is recommended that attendees preregister in order to receive the advance information which allows them to preplan and schedule their visit to the Show and Conference. However, badges and tickets can be purchased at the Show.

ANY QUESTIONS? Call 800-841-7000 (Boston).

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Exhibits Only . . . . . $8 per day

Conference Program . . . . . $15 per day

Check Applicable Box:

☐ Enclosed is my payment for _____ quantity PC '83 three-day Exhibits and Conference badge(s) at $48. *You save $21.*

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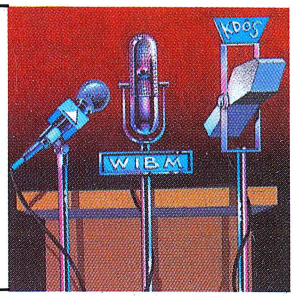


Unless otherwise indicated, software listed runs in DOS on machines with either display adapter and requires 64K and at least one disk drive.

Δ Fly a single-engine Cessna 182 when you boot *Flight Simulator*, the new skill and strategy game from **Microsoft** (10700 Northup Way, Bellevue, WA 98004; 206-828-8080). As you progress in skill, you can alter various conditions, such as time of day, cloud cover, season, wind shear forces, and a reality mode that requires attention to the finer details of flying such as trim, carburetor icing, and fuel usage. Includes radio navigation ability. Requires color/graphics adapter. Composite color monitor recommended. $49.95.

Δ **Volition Systems** (Box 1236, Del Mar, CA 92014; 619-481-2286) announces version 0.3 of the programming language, Modula-2, designed by Niklaus Wirth, the creator of Pascal. The module library has been redesigned to permit the development of portable software systems. $40. With the book *Programming in Modula-2*, by Niklaus Wirth: $50.

Δ The Sixshooter, a combined function board, features RAM, serial port, clock and calendar, and game controller adapter. From **Micro Synergy** (1327 Whitacre Drive, Clearwater, FL 33516; 813-535-6655). $525.

Δ Let your pc speak in a variety of audio applications with the ParlePC adapter from **GM Enterprises** (485 East Granville Avenue, Roselle, IL 60172; 312-893-1171). The unit has on-board audio amplifier, speaker, and jack. Can be used with direct text to speech algorithms. $199.

Δ **Amdek** (2201 Lively Boulevard, Elk Grove Village, IL 60007; 312-364-1180 announces the Color-I Plus color monitor. Features nonglare screen, headset, and automatic cut-off of speaker when jack is inserted. $449. Δ The Amplot II is a six-color plotter that features a high-speed pen, automatic pen retrieval and .002" resolution for fast, accurate plots; ten-by-fourteen-inch plotting range; and ability to receive ASCII commands. $1,290.

Δ *Micro LawPack*, a financial management package for law firms, is announced by **CompInfo** (1860 Broadway, New York, NY 10023; 212-246-7340). Totally integrated with the mainframe *LawPack*, the system uses *VisiCalc* for budgeting and financial modeling. $1,000.

Δ A seven-module business and accounting package, *The Business Library*, is designed to the specifications of a Big Eight accounting firm. Includes password security. From **Software Libraries** (Box 844, Pasadena, CA 91102; 213-793-1700). $595.

Δ **STB Systems** (1701 North Greenville, Suite 703, Richardson, TX 75081; 214-234-8750) introduces a multifunction board called the Super RIO. The board features 64-768K of parity-checked RAM, a printer/SASI disk-controller port, two serial ports, and a clock/calendar. From $595. Piggyback cards, from $349. Δ The *PC Accelerator* combines print spooling with disk drive emulation. $79.95.

Δ An extension of the **Persoft** (2186 U.S. Highway 51, Stoughton, WI 53589; 608-873-8888) TE100 VT series terminal emulator, TE100-FT adds bidirectional file transfer capabilities and allows transmission of ASCII files and data. $150.

Δ *Telecom Times & Trends* is a monthly newsletter that promises to provide prophecy of where the computer revolution is heading. Sample issue from **Frank Communications Group** (Box 144, Mount Vernon, NH 03057; 603-673-8431). $195 per year. ♥

Δ Four-color hi-res graphics is possible when the enhanced *GraphPower* is used with the Plantronics/Frederick Electronics Colorplus board, according to **Ferox Microsystems** (1701 Fort Meyer Drive, Suite 611, Arlington, VA 22209; 703-841-0800). Graphs and charts can be previewed before plotting and can be filed for future use. $295.

Δ Print signs and notices with block characters one inch high, using *Blowup*, from **Robert A. Murray & Associates** (9110 Thirty-first Avenue N.W., Seattle, WA 98117; 206-783-9494). Handles a set of ninety characters in a ten-character-by-ten-line image area. $24.95.

Δ The IBM PC Faire will be held in San Francisco's Civic Auditorium and Brooks Hall, August 26-28. The three-day conference will include a major technical conference with published proceedings, as well as exhibits and speakers. Sponsored by **Computer Faire** (345 Swett Road, Woodside, CA 94062; 415-851-7077). Call for ticket and exhibitor information.

Δ A mortgage amortization program that prepares tables and provides monthly and yearly breakdowns, *Amsched* is available from **D2 Enterprises** (Box 871, Shalimar, FL 32579; 904-651-3108). $30.

Δ *D2Form* is a screen forms generator that allows you to create your own forms on screen. $45. Δ A handy pocket-sized programmer's tool, *PC-Companion* is a reference card that lists all 255 ASCII codes. $1.

Δ Interface directly with mainframe IBM 3274 and 3276 Cluster Terminal Controllers by means of the Model 5278 interface from **Agile** (25 East Trimble Road, San Jose, CA 95131; 408-946-7576). Package consists of board, software, and keyboard overlay. Built-in diagnostics. $1,595.

Δ *MicroFCS* allows any model developed on a pc to be run on a mini or mainframe with no change in syntax. Maintain only one source code. From **EPS** (One Industrial Drive, Windham, NH 03087; 603-898-1800). $2,000.

Δ Turn the pc into an even better register for retail sales and inventory control with the Level 2.0 enhancement of *EZ-Retail*, from **Data Consulting Group** (877 Bounty Drive, Foster City, CA 94404; 415-349-4001). Improvements include inventory reorder point control, enlarged item-number field, and product cost display. $245. Mailing label option: $75.

Δ A *SuperCalc*-compatible version of *Quickcalc Real Estate Investor* is released by **Simple Soft** (480 Eagle Drive, Suite 101, Elk Grove, IL 60007; 312-364-0752). Analyzes both residential and income-producing property sales and purchases. $129.95.

Δ SoftCable, a serial print spooling and flexible serial interface, lets you process while printing, using 1K to 500K buffers. From **The Gauge Group** (Box 34082, Phoenix, AZ 85067; 602-279-1533). $59.95.

Δ *Datafax* is an informal data manager that is hard-disk compatible. The program stores data in the form of electronic index cards; several cards can be stored as a folder, and up to sixty key words can be associated with each folder for subsequent data retrieval. Program also allows splitting and merging of databases. From **Link**

The Spelling Bee Is Over

Listen. We're going to let you in on an industry secret: It's not hard to make a good spelling checker.

You see, although spelling checking is new for microcomputers, it's been around on big computers for *years*. And when you get past all the talk, most spelling checkers work the same way. They compare what you've written with a dictionary—and report the errors.

So is there *any* difference? You bet: the dictionary, and the price.

Who Checks The Checker?

The hardest part of a spelling checker to make is the dictionary. It's hard to pick the right words—and spell every one of them perfectly. That's why some popular spelling checkers don't even contain real dictionaries. They use formulas called "hash tables." Which make a hash out of your spelling some of the time.

Other spelling checkers "borrow" their words from printed dictionaries —or copy them from old word lists. Or give a programmer who can't spell "programmer" a chance to write his first dictionary. And as though all this wasn't bad enough, a lot of these companies want to charge you $100, or $200 or even $300!

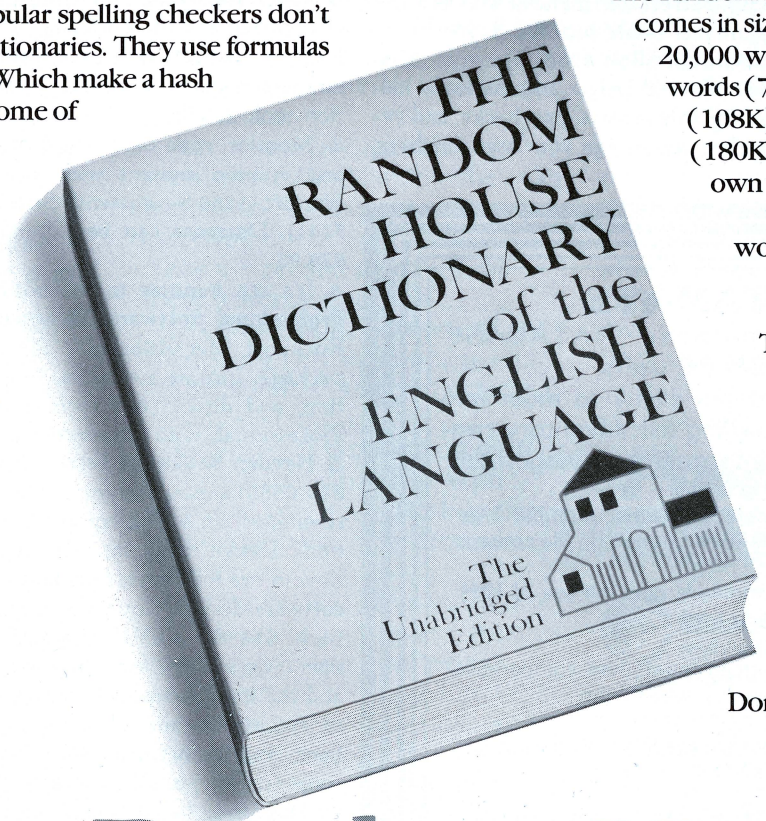
Random House to the Rescue

The Random House ProofReader is based on the famous Random House Dictionary. It is the result of decades of careful work. And it was adapted for computer spelling checking by professional editors, linguists and scholars. So you can depend on it.

Of course, our program is darn good, too. It's fast. It doesn't take up too much disk space. It shows you the error and the sentence it's in. It lets you correct the mistake without reediting. And if you don't know how to spell a word, it suggests the spelling. It even corrects your correction.

The Random House ProofReader comes in sizes to fit all systems: 20,000 words (55K), 32,000 words (74K), 50,000 words (108K) and 83,000 words (180K). You can add your own words with a single keystroke. And it works with all CP/M®, IBM Personal Computer®, and TRS-80® Model I/III word processors.*

How much does the Random House ProofReader cost? Only $50.00. Why do we sell it for $50 when the others want up to $300? Don't ask us. Ask them.



The Random House ProofReader $50

For orders or information, call 505-281-1634. VISA, Master Card accepted. Or write Random House ProofReader, Box 339 Tijeras, New Mexico 87059. Please enclose $50 and specify your computer model, disk size and memory. Dealer inquiries invited.

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Systems (1640 Nineteenth Street, Santa Monica, CA 90404; 213-453-1851). $199.

Δ The **Strohl Systems Group** (661 West Germantown Pike, Plymouth Meeting, PA 19462; 215-825-6220) announces the *Strohl Stock System.* Actually makes buy and sell recommendations to the trader by its automatic analysis of trends. The system features single keystroke log-on to Dow Jones News Retrieval System. $495.

Δ *MBA* users can now transfer their previously developed *VisiCalc* models to the more powerful *MBA* program with a converter supplied by the makers of *MBA:* **Context Management Systems** (23864 Hawthorne Boulevard, Suite 101, Torrance, CA 90505; 213-378-8277). $49.95.

Δ **Perfect Software** (1400 Shattuck Avenue, Berkeley, CA 94709; 415-644-3644) introduces their line of software: *Perfect Writer,* a word processor. $495. Δ *Perfect Speller,* a spelling checker, $295. Δ *Perfect Filer,* a relational database. $595. Δ *Perfect Calc,* a spreadsheet program. $295. All four feature split screen and multiple file display.

Δ A property management system called *The Landlord* is released by **Systems Plus** (1120 San Antonio Road, Palo Alto, CA 94303; 415-969-7047). It can generate reports for each property or owner, or generate summary reports by owner; can manage up to one hundred properties or owners. $595.

Δ Real estate investment analysis can be done with *Real Estate Analysis,* from **Digital Marketing** (2670 Cherry Lane, Walnut Creek, CA 94596; 415-938-2880). Perfect for financial advisors, developers, architects, attorneys, or real estate brokers. $195.

Δ Business software from **Datasmith** (Box 8036, Shawnee Mission, KS 66208; 913-381-9118): *General Ledger* automatically balances your books. $300. Δ *Payroll* prints reports, paychecks, and W-2 forms. $400. Δ *Data Manager* lets you design your own database. $450.

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Δ *IBM Basic for Business and Home* is a book full of practical and instructive programs you can use as models to design your own applications. Includes a section on analyzing and designing applications. Published by **Reston Publishing** (11480 Sunset Hills Road, Reston, VA 22090; 703-437-8900). Softcover, $14.95.

Δ From **Prentice-Hall** (Box 500, Englewood Cliffs, NJ 07632; 201-592-2000): *A Unix Primer,* a beginner's guide to the system, with analogies and practical exercises. Hardcover, $19.95.

Δ Update kits for the Cobol Compiler and the USCD p-System have been announced by **IBM** (Box 1328, Boca Raton, FL 33432; 305-998-2000). The updates provide corrections and enhanced performance. Available through authorized dealers.

Δ *Target Financial Modeling* is a spreadsheet program that features plain English commands, report generation, consolidation, conditional logic, forward referencing, and an array of advanced modeling features. Can interface with a variety of databases and word processors. Available from **Comshare** (3001 South State Street, Ann Arbor, MI 48106; 313-994-4800). $325.

Δ A series of travel cases for the pc offer complete protection with less weight, according to their manufacturer, **Fiberbilt** (601 West Twenty-sixth Street, New York, NY 10001; 212-675-5820). The rugged Fibrex cases feature heavy-duty aluminum frame coupled with steel corners and a fully padded interior, yet weigh only twenty pounds each. Case for CPU and keyboard: $161; case for monitor and printer: $171.

Δ Three new programs from **C & C Software** (316 Nancy Lynn Center, Suite 26-B, Knoxville, TN 37919; 615-584-9774): *Dungeon Duel,* a fast-action arcade game. $29.95. Δ *Space Pirates 3000,* strategy in space. $34.95. Δ *Football Predictor '83,* a statistical prediction tool. $39.95.

Δ Monitor your daily consumption of food for caloric, mineral, and vitamin content with *The Dietary Analysis System,* from **Simsoft** (1258 Seventeenth Street, Marysville, MI 48040; 313-364-7241). Database can be expanded from 500 to 800 food types. $29.95.

Δ It's ten minutes to the bottom line with tax templates from **Professional Software Technology** (Whistlestop Mall, Box 269, Rockport, MA 01966; 617-546-2073). New features on this year's package: income averaging, new tax tables, automatic tax calculation, and direct 1040 form printout. Available in two versions. Professional, with corporate forms: $150; personal: $100.

Δ **Hayden Books** (50 Essex Street, Rochelle Park, NJ 07662; 201-843-0550) announces the publication of *Software Toolkit for Microcomputers,* an edited compilation of forty-three articles from *Electronic Design* magazine. The articles provide a detailed analysis of how to use high-level languages and operating systems to speed up software design. Covers Fortran, Cobol, Basic, and Pascal. Paperback. $14.95. Δ *CP/M Revealed* is an exploration of the popular operating system, including the console monitor, system manager, and the input/output driver package. Includes detailed discussions of logging on, mapping disk space, and other functions. Paperback, $13.95. Δ *Create Word Puzzles with Your Microcomputer* is a collection of puzzle programs that allow you to create acrostics, cryptograms, word-finds, quote-falls, fall-ins, and other word puzzles. The book's seventeen Basic programs produce twenty-five puzzles. Paperback, $14.95.

Δ *AutoCAD* is a 2-D computer-aided drafting and design package suitable for a wide variety of architectural, landscaping, mechanical, and electrical applications. Acting like a word processor for drawings, it lets you draw from simple components—lines, circles, arcs—and annotate them with text. From **Autodesk** (16 Saint Jude Road, Mill Valley, CA 94941; 415-381-1819). $1,000.

Δ Now you can look at a disk and see a neat alphabetical list of the files on it, using the *Label Kit PC Disk Organizer* from **PC Goodie** (15445 Ventura Boulevard, Suite 10, Sherman Oaks, CA 91413; 213-995-8565). Offers automatic labeling with any printer. $59.95.

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QUESTIONS TO ASK YOUR SOFTWARE SUPPLIER BEFORE HE SELLS YOU A WORD PROCESSING SYSTEM FOR YOUR IBM PC.

Ask a computer products dealer for word processing software, and chances are he'll try to sell you Wordstar.

It's a pretty good system. Lots of people use it. And besides, he's got it in his inventory, and you can take it home with you right now.

But before you settle for Wordstar, remember that—whatever system you choose—you'll be using it for a long time. So your decision should be based on *system performance*—not what the dealer happens to have on hand.

That's why you should look into PowerText.

Quite simply, PowerText will do far more for you than Wordstar.

We realize that's a very tough claim. But the Wordstar users who've switched to PowerText will tell you it's true. And if you'll read on, we'll give you some key questions to ask your dealer:

Ask if Wordstar automatically styles your copy for any kind of document you write. Can you tell Wordstar, "This is a letter," and then get a perfect letter, with the date, name and address, salutation, and closing exactly where you want them to be—automatically?

Does Wordstar produce memos, reports, presentations, and scripts in precisely the formats you want without your ever having to worry about where the words go on the paper?

Well, Wordstar *doesn't* do those things for you. But PowerText *does*.

That means with PowerText you can concentrate on what you're writing, not on printed style. You always get a beautiful, perfectly formatted document—automatically.

Just think of how much time and effort these remarkable capabilities will save you. It's almost like dictating to your computer.

PowerText gives you automatic margins. Indents. Spacing. Title page. Envelope or label.

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And an enormously useful feature that automatically indents and numbers for you when you write numbered paragraphs—a great time-saver when you're doing outlines, reports, or questionnaires.

Plus columnar capabilities so sophisticated and flexible they can handle just about any problem you can think up.

Ask if Wordstar gives you all these features. (It doesn't.)

Of course, both PowerText and Wordstar give you complete editing capabilities. All good word processing systems do.

But PowerText gives you *built-in* form letter capability. With Wordstar, you'll need to buy the Mailmerge® system to produce form letters.

And PowerText gives you automatic headers and footers. *And* boxed copy. *And* print macros. *And* automatic footnote numbers.

And boilerplate inclusion. *And* vertical and horizontal border lines. *And* 132-character lines. *And* superscripts and subscripts.

With PowerText there's no limit to document length. And PowerText accommodates a full 25 percent more data per disk than Wordstar (or standard IBM software).

PowerText is a straightforward, easy-to-learn, easy-to-use system. You'll master it quickly with our superb new 10-lesson tutorial. You get a complete reference manual, too.

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Δ **Micro Vision** (135 Herzel Boulevard, Lindenhurst, NY 11757; 516-226-7130) brings you *Tax Relief*, a modular tax preparation package for tax professionals and individuals. Prints signature-ready forms and schedules in IRS-approved formats. Form 1040 version: $39.95. Professional version (all forms): $129.95.

Δ New improved versions: *Versatext*, a word processor that's now ten times faster. $199.95. Δ *Thinker*, a spreadsheet program that can link twenty spreadsheets in a summary sheet. $75. Δ *P.C. File*, a database that stores up to 200 lines of retrievable information. $49.95. All three from **TexaSoft** (3415 Westminster, Dallas, TX 75225; 214-369-0795).

Δ The second in the Trix series of educational games has been released from **Insoft** (10175 S.W. Barbur Boulevard, Suite 202B, Portland, OR 97219; 503-244-4181). In *Quotrix*, you follow a trail of clues using crossword puzzles, trivia questions, foreign word translations, and other games to deduce a famous quote. There are 700 quotes to tackle. $34.95.

Δ The Omega Data X7 intelligent display terminal has a seventeen-inch CRT that lets you see spreadsheets in their entirety and a split-screen capability that lets you see both pages of a two-page letter. With graphics option, ASCII upper and lower case, 32K display memory, and keyboard. From **Quadram** (4357 Park Drive, Norcross, GA 30093; 404-923-6666). $2,595; with graphics option: $2,850.

Δ **Hayes Microcomputer Products** (5923 Peachtree Industrial Boulevard, Norcross, GA 30092; 404-449-8791) announces *Smartcom II*. Supported by the auto-dial/auto-answer Smartmodems, the new communications software automatically originates and answers telephone calls. Commands stored as macros; no need to rekey to enter remote databases; select and store up to twenty-six macros. $119.

Δ Five action-packed weekends for kids to learn all about computers are planned from July 3 to August 5 in three locations across the country by **National Computer Camp** (Box 585, Orange, CT 06477; 203-795-9667). The camp is for kids of all levels of experience—including no experience whatsoever. In addition to hands-on instruction in computers, campers will enjoy recreational facilities including swimming and tennis. For further information, contact Michael Zabinski.

Δ The Second Annual New York Computer Show and Software Exposition will be held Thursday through Sunday April 14-17 at Long Island's Nassau Coliseum. Thousands of peripherals, accessories, and software items will be exhibited. Sponsored by **Northeast Expositions** (822 Boylston Street, Chestnut Hill, MA 02167; 617-739-2000). Admission: $5. Δ The Third Annual Southwest Computer Show and Software Exposition will be held Thursday through Sunday, April 28 to May 1, at the Dallas Market Hall. Admission: $5.

Δ A communications program that turns your pc into a host computer is available from **N.F. Systems** (Box 76363, Atlanta, GA 30358; 404-252-3302). *HostComm* can accept orders twenty-four hours a day, receive electronic mail, and give you long distance access to your own computer. Requires Hayes Smartmodem. $139.95.

Δ **Sybex** (2344 Sixth Street, Berkeley, CA 94710; 415-848-8233) has just published *Mastering VisiCalc*, a user's guide that describes and illustrates the functions of the spreadsheet program. $11.95.

Δ *Doing Business with VisiCalc* includes over forty applications for accounting and management planning. $11.95. ▲

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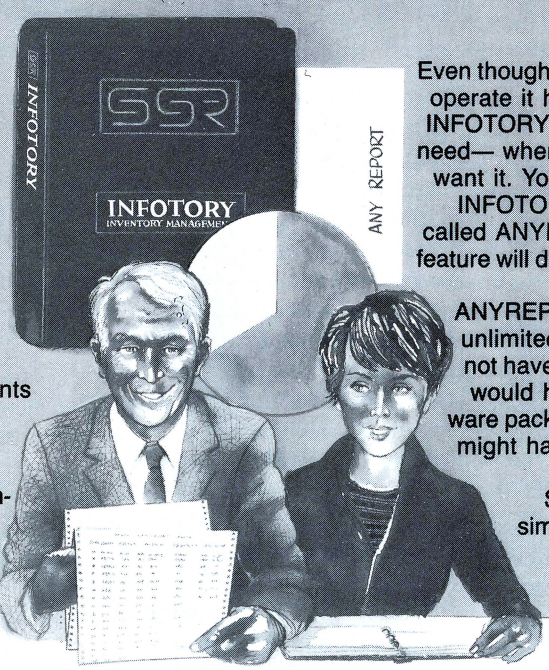

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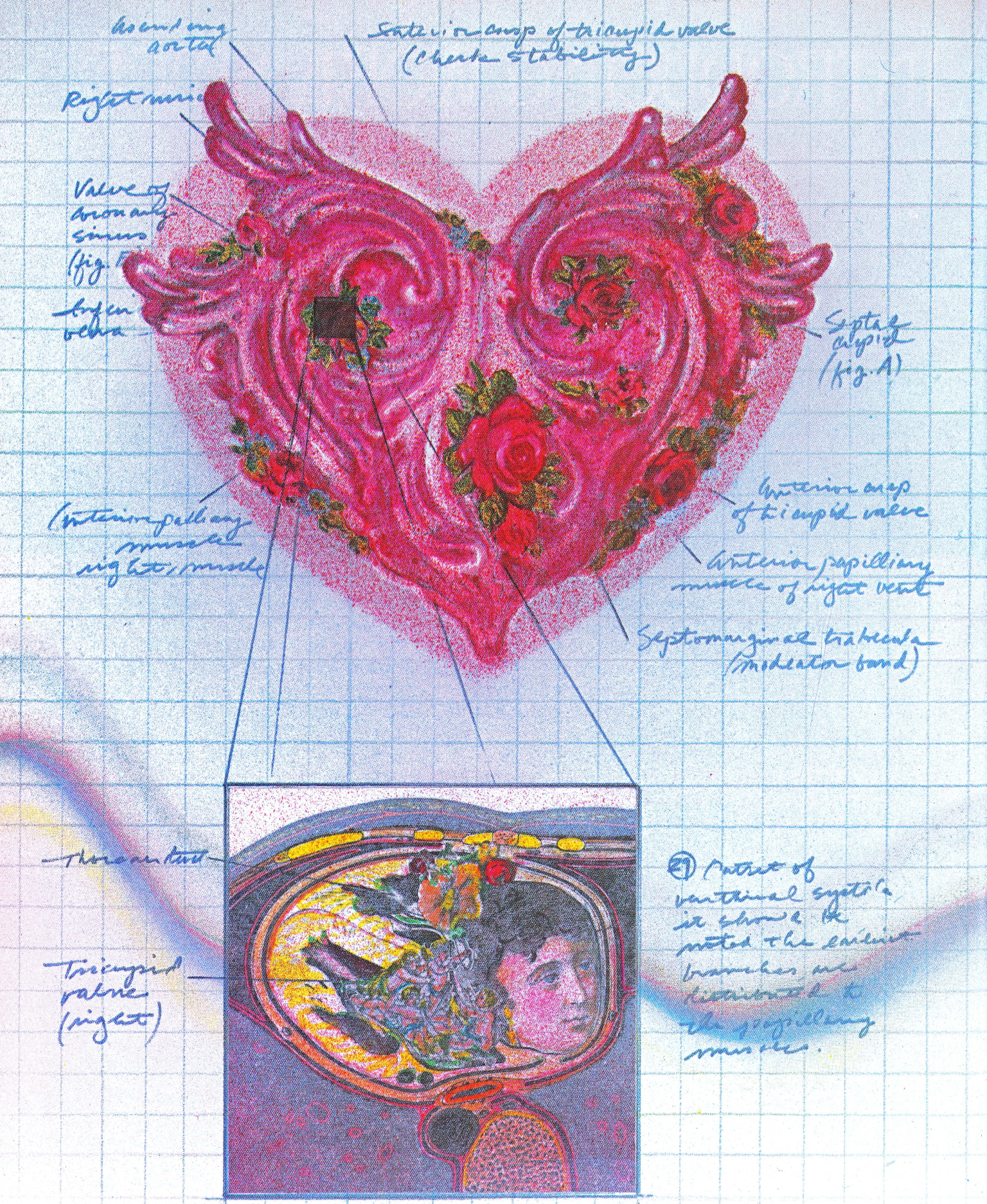


(2) Outset of ventricular systole it should be noted the earliest branches are distributed to the papillary muscles.

1.1 The interior of heart revealed within interior surgeons. The rest of the front is burn turned over. Barry K Hoff 1.83

(30) From this nodule tendinous fibers are radiated through the Septine cupid to its attached margin from two portions.

1.4 fig. A

1.4 fig B

1.4 fig C

Romance à la Modem

MESSAGE 21 IS FROM: MARC2
TO: ALL
SUBJECT: a few changes have been made

THE SYSTEM IS UP! It took more than I expected, more of a re-write than a conversion, and while I was doing it I added a few things . . . Durn I'm sleepy . . . I'm gonna hit the hay, good thing computers don't sleep . . . take care all . . . Marc

DAVID5 MATCHMAKER CLOSING COMMENTS
My god the Martian has been busy! Keep up the good work.

Matchmaking is a way of life for Marc "The Martian" Schoenberg. It's his job, his hobby, his addiction, his art, and "a great way to meet people."

Forty hours a week Schoenberg plays computer matchmaker. With his rock and roll Prince Valiant haircut and soft, acoustic-guitar voice, he looks and sounds too comfortable to be wearing a tie and working in a corporate cubicle. But there he is, systems analyst in the information systems department of National Medical Enterprises, Santa Monica, California. By day, Schoenberg fixes dates for lonely pcs, matching micro needs to micro knowledge throughout this international health care provider's network of forty-eight hospitals.

Men, Women, and Martian Machines. By night and on weekends, the tie comes off and he curls up at home with a keyboard on his lap, chatting, joking, and meeting new friends—all via modem. With the help of his pc (*Marc the Martian's Mixed-up Matching and Message Machine*), Schoenberg becomes the Martian Matchmaker, running a twenty-four-hour bulletin board service that hooks up "Earthlings" with similar interests for any purpose from friendship to courtship.

When National Medical discovered over ninety micros in the midst of all the mainframes they use, they promoted Schoenberg to micro coordinator. "Personal computers are becoming more legitimate for use in hospitals now that the government has changed regulations regarding Medical and Medicaid insurance," says

by Michael Ferris

Illustration by Barry K. Hoff

Marc the Martian's madness may be monitored at (213) 390-3239.

More Matchmakers

DYM #1	Burbank, CA	(213) 842-3322
DYM #3	Savannah, GA	(912) 233-0863
DYM #4	Sherman Oaks, CA	(213) 783-2305
DYM #6	Fairbanks, AK	(907) 479-0315
DYM #9	Tarzana, CA	(213) 345-1047
DYM #10	San Francisco, CA	(415) 566-9927
DYM #11	Glendale, CA	(213) 242-1882
DYM #12	Houston, TX	(713) 556-1531
DYM #14	Cranford, NJ	(201) 272-3686
DYM #16	Vancouver, WA	(206) 256-6624
DYM #17	Daly City, CA	(415) 991-4911
DYM #18	Lynnfield, MA	(617) 334-6369
DYM #20	Cary, NC	(919) 362-0676
DYM #21	Freeport, NJ	(201) 462-0435
DYM #22	Sherman Oaks, CA	(213) 990-6830
DYM #23	Omaha, NE	(402) 571-8942
DYM #25	Burbank, CA	(213) 842-9452
DYM #26	Clovis, CA	(209) 298-1328
DYM #28	Sun Valley, CA	(213) 764-8000

Schoenberg. "Those changes just ripped the billing system apart. Everybody's doing more what-iffing than they ever had to do before." ♥

Schoenberg's duties at NME include reviewing software packages and "looking through tons of magazines and calling people." He is also currently exploring the *Irma* interface, software that lets the pc impersonate an IBM terminal—a valuable skill for a micro in NME's mainframe universe. Coordinating microcomputer applications in one part of the country with corresponding needs in another also keeps the Martian active.

He likes riding shotgun on a variety of projects. "The company is very progressive; they don't pigeon-hole you here. They want to keep you happy doing your job," he says.

It's clear he loves his job matchmaking computers. "I like it because I'm a floater. I go along as a resource, handling the smaller projects and the micro stuff. I don't have to feel stuck."

It's also clear, however, that his true calling is human matchmaking, via computer. "It can get addicting. I started my own board after a couple of months of $300 phone bills from calling up services around the country. It's a great way to meet people."

A phrase repeated by several of his happily matched-up friends.

Gone with the Bulletin Board. It was a four-month bout with a Delphi timesharing bulletin board in a beta test that hooked Schoenberg on bulletin boarding. "I went bananas on the system, eighteen hours a day, chatting and sending electronic mail. I quit only when I saw the Timenet charges." Because he's such a compulsive conversationalist, it's easy to see why Schoenberg started his own service, one that reflects his own personal feelings and taste.

MMMMMM began in October 1982, as *Dial Your Match* number nineteen on Schoenberg's Apple. *Dial Your Match* is a software system developed by Greg Collins, a graphics programmer in Burbank, California, who grew disenchanted with bulletin boards. Collins created the current *DYM* software in 1981, "just for fun." His was for a while the only such service, but eventually he made the code easier to customize, and now "they're up all over the country" The *DYM* program allows for thirty-six sexual preference matching possibilities.

Schoenberg has arranged with Collins to create an IBM version of the *DYM* software for commercial release. Schoenberg's service is "mixed-up" because it's still in the beta test phase. Some of his improvements will show up on the pc version of *DYM*, but Schoenberg plans to maintain his own unique system as well.

The Apple is "okay for hobbyists, but not for twenty-four-hour use," says Schoenberg. After a while he grew dissatisfied with the limits of running the *Match* package on the smaller machine, so he opened up a "for sale" category on his board, sold the Apple, and bought a "super powerful" pc.

Programming the pc is "quick and easy," says this ten-year veteran programmer. "I was able to throw away about 5K worth of subroutines right off the bat." On the Apple, the communication

line is the keyboard, so the Apple *DYM* software had required a lot of security trapping to keep callers from getting to the computer's operating system. Schoenberg was able to dispense with these measures on the pc, where communication lines are treated as files.

♥ **Love Is a Many Splendored Program.** Ever since he began carving and polishing the program last December, it has taken on more and more of its own character; hence the temporary title switch. "I wanted to alert people they were calling a service that was a little bit different."

On Christmas Eve, 1982, after six days of nonstop reprogramming, Schoenberg went on-line with his souped-up bulletin board. He ran a notice on the eighteen other existing *Match* boards, and in six days he made 160 new friends. Some were old pals from his Apple club; others had heard of his reputation for running a clean board and had called to log on. The board continues to log new callers each week.

While a lot of boards encourage the kinkier kinds of correspondence, the Martian plays it down. Schoenberg is helping to bring back the grand art of letter writing.

Users join the tradition of Cyrano, Romeo, Shakespeare, Shelley, Robert Browning and Elizabeth Barrett, and history's other great letter-writing lovers. Future Gertrude Steins and Alice B. Toklases, however, will have to use another service.

Dial Your Match software matches for a wealth of sexual combinations—gay, straight, and bisexual—most of which Schoenberg wasn't interested in. He didn't like men writing him for dates and didn't want to meet bisexual women. His service, in contrast to the freewheeling correspondence possible on the other services, offers something relatively uncommon these days—plain old-fashioned heterosexuality.

The Martian's machine will only match straight men with straight women. This restriction cuts down on all the competing noise and interference from other faces of the sexual die. "Those with other preferences can start their own services if they're really serious about meeting people who share their own inclinations," says Schoenberg.

Mellow Martian Machinations. A way to meet friends of the opposite sex with common tastes is what Schoenberg features on his service. "Mellow interest matching" is the theme. One of the more important differences between his system and the Apple *DYM* is that his allows users to find others who show a high degree of concordance in specific interest areas, such as music and hobbies.

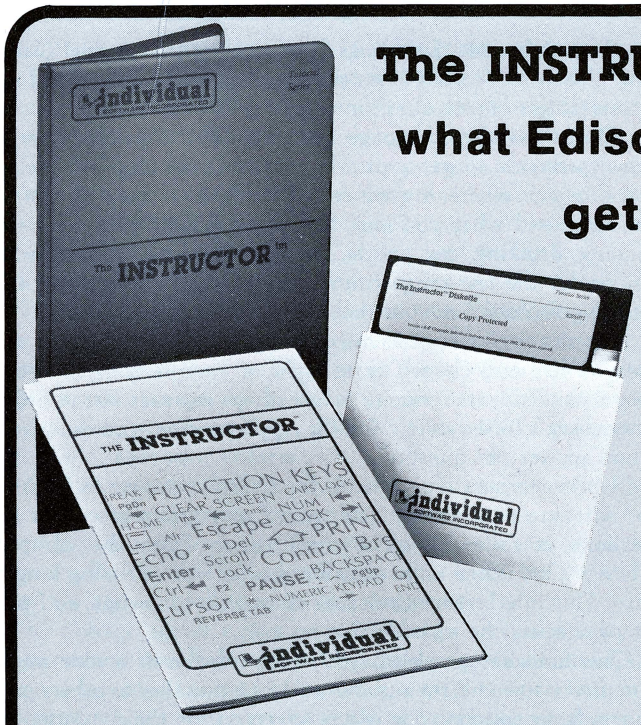
The feature of the Apple version that bugged Schoenberg the most was its provision of only one public board for messages. He has split the public area of his system into ten separate categories of exchange.

One of these categories is made available for the sexier, more explicit, correspondence, called x-rated by users. On other services, the raincoat crowd flashes its messages to all, whether anyone wants to read them or not.

"The women don't like all that x-rated stuff. It turns them off," he says. "I try to put all the junk in one corner and keep the rest of the system clean." Schoenberg is a sort of modern-day knight of the modem, the pc his Excalibur; his mission is a renaissance of chivalrous courtship, computer-style.

The ratio of men to women on his service is ten to one. That's a situation he wants to rearrange, by encouraging more women to log on. "And you can't do that with all kinds of perverts on-line, and gays and bisexuals cluttering up the boards," he says.

Schoenberg's service can be dialed from any make of computer with a modem, and from anywhere in the country at any time of day. When you dial 213-390-3239, you'll get a welcome message



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ROMance at Rich's

At the eleven branches of Rich's Department Store in Atlanta, Georgia, bridal gift matchmaking is a tradition. Of 23,000 couples that applied for marriage licenses in the Atlanta area last year, 9,099 brides registered their choices of wedding gifts at Rich's.

This ongoing romantic activity has inspired a marriage of another kind, a wedding of technology to tradition. At this wedding the pc was best man.

Rich's began their bridal registry back in the 1890s, and in the peachtree city this tradition is as strong as it is old. Specially trained saleswomen known as bridal consultants are the grand matrons of the tradition. They accompany a bride or couple around the store, advising and faithfully recording choices of color, pattern, brand, and price.

There are twelve categories of wedding gift selection—flatware (formal and casual), china (fine and casual), crystal stemware, bed and bath linens, cookware, and so on. Twenty selections can be made in each category. Once a bride and groom have completed their selections, an entire imaginary home has been "accessorized." That is, unless the bride and groom have a change of heart about the gifts they'd like.

Registering anything is always a mess of paperwork, and people do change their minds, even after gifts have been purchased. This means worn files, stubby pencils, and returned gifts. But what's a time-honored tradition without a little fuss and irritation? It comes with any job.

What didn't come with registering brides eighty years ago was the personal computer. That's a recent and welcome addition—even if a touch of computer fear comes along. After all, what's innovation without a little risk?

Now a couple's gift choices are entered into a pc, where changes can be made easily. And any of Rich's outlets can produce a wish-list printout for the convenience of conscientious gift-givers.

The pc first met the bride at Goldsmith's in Memphis, Tennessee, a corporate sister store to Rich's. Goldsmith's has six stores in the tri-state area of the mid-South and registers about two thousand brides each year. Both store chains are owned by Federated Department Stores; the company also owns Bloomingdale's in New York City.

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and the number of "Earthlings" currently stored in the "Date-A-Base." Then, if it's your first call to the board, you'll be asked to fill out a multiple-choice questionnaire.

"Does Assembly Language Turn You On?" The computer asks a few questions to get a profile of you: name, age, sex, marital status, height, where you are calling from, what kind of computer you have, and what you look like. Then it asks your opinion on smoking, drinking, sex, sports, relationships, and exercise (answer options for the last range from *Yes! Yes! Yes! I'm a health nut* to *Watching Richard Simmons makes me tired*).

You also get to name as many as eight of twelve kinds of music that you like and choose up to eight of seventeen listed hobbies. This expanded questionnaire is one of the features found only on Schoenberg's IBM version. On the Apple version, you can give only one answer per question.

"I brainstormed with friends for six hours trying to figure out the right questions to ask," he says. Every group of two or three questions is followed by a confirmation from the computer. "There's a lot of line noise sometimes when you're calling long distance. This interference can cause characters to change, so I put in lots of checks," he adds.

Questionnaire completed, you're rewarded with a code number. Your first name and the number are your moniker to others on the system. Your address code will be given out by the computer to all persons who match to you. You can also give it to other board users from whom you want to receive private mail.

Each user of the Martian's service is allotted ten private mail slots; each mail slot can store a message up to fifty lines in seventy-two-column format.

Stroking and Scrolling. Once you're past the preliminaries, you have a selection of one-keystroke commands open to you: these allow you to scroll one of the ten public message boards, make a

Systems analyst Patti Cole (standing), project manager Larry Black, and training coordinator Sarah Rowley put one of Rich's bridal registry pc systems to the test.

Senior systems analyst for Goldsmith's, Ron Pruitt, is the man who spearheaded the pc project.

"We were looking for a way to automate the bridal registry process," says Pruitt. "It costs less to run it on computers, plus they give it a certain uniqueness."

The pcs, at Goldsmith's as well as at Rich's, are linked over phone lines to a central minicomputer. The mini stores the bridal records. "The microcomputer doesn't have the storage capacity to hold over 150,000 separate entries, even with a hard disk," explains Pruitt.

The software, designed by Gary Irwin and Associates, Irvine, California, began playing the Wedding March last October, as a colorful bride and groom marched across the screen. "We jumped right into it. Of course there were a few bugs, but you can't think of everything at once," says Pruitt. "Customers were a little slow in adapting to computerized preference lists, because they were used to flipping through a book."

Rich's in Atlanta had the benefit of Goldsmith's beta test of the registry, but there were a few programming changes that Patti Cole, Rich's twenty-six-year-old systems analyst, needed to make.

"There were a couple of things that just drove the operators crazy," says Cole. "When the bridal department people went in to do their nightly reports, the program asked them for six different dates; I changed it so it asked for one. The rest of the dates only need to be updated once a year."

The program would also flash an ominous "Call data processing with error" each time a duplicate entry was made. Cole changed this to read, "This is a duplicate record," so the computerized bridal world wouldn't have to stop each time a plate or a spoon was entered twice.

The pcs themselves are out on the public floor, in the bridal registry section of the china and silverware department. Originally it was thought the brides themselves could enter the data, but Cole says the program doesn't have enough error protection to allow that. The consultants have participated in special training programs that teach them to run the registry and "give them a better feel for computing as well as take the scare out of it."

In selecting their preferences at Rich's, "Brides always ask for formal flatware and fine china," says Cole. "But a lot of brides don't get either of those because they're too expensive." That's why Rich's pcs print prices alongside items on the preference list that's given to gift buyers.

"Of course," she adds, "some brides get everything they ask for." ▲

---

match, read or send private mail, browse questionnaires, or chat with the Martian himself, if he happens to be home.

Forty percent of Schoenberg's callers indicated computer consulting as an interest, so one of the message boards acts as a job center. The IBM board is a technical area for pc buffs. Another board is devoted to aviation, because Schoenberg has a private pilot's license. The remaining boards are titled Dating, For Sale or Trade, Ham Radio, Jokes, Miscellaneous, Skiing, and X-Rated.

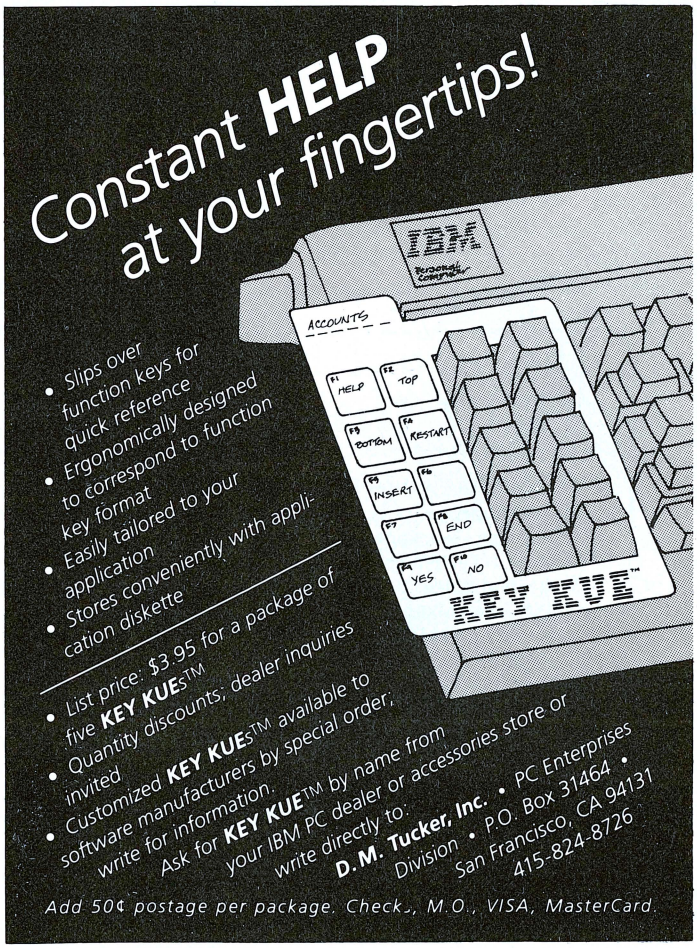
A press of the letter M, for "Martian, Make Me a Match" delivers a list of all the database members who match your preferences. Schoenberg's system compares users' questionnaires and calculates the percentage of match between them. When you select the M option, you also specify the minimum percentage of match you'll accept, and the system produces a list of those users of the opposite gender who meet your criteria.

After you've seen the list, if you want more information about particular people, you can bring their questionnaires up on your screen. If you want to meet them, you can leave messages in their mailboxes. Private mail is screened from other users, but the Matchmaker has access to all files—public and private.

The average age of callers on Schoenberg's service is thirty, for both males and females, and they're mostly single or divorced. One caller is a seventy-five-year-old woman, a neighbor of a couple on the service. "She's really great to talk to," Schoenberg says.

❤ **My Favorite Matchmaker.** So far the Martian has sunk about $3,000 into his system—keyboard, monitor, single disk drive, and modem—and sees how easily he could spend more. "The pc allows for two lines as standard equipment; all I'd need is another modem and phone line." A five-megabyte hard disk is on its way, the result of a trade for some professional consultation. "Bulletin boarding can be an expensive hobby," Schoenberg notes.

For him, however, it's the only hobby. "It can get real addict-



ing, talking to people all the time. You get hooked." His computer runs twenty-four hours a day and he can't use it for anything else unless he shuts the software off. Schoenberg is reluctant to do that, even to make improvements. When his pc is down, incoming callers get a busy signal. "I like to keep it open. If the line's busy all the time, it discourages callers."

Many first-time users don't seriously count on meeting someone through a computer; surprisingly, though, it does happen quite often.

Lucia3 is a student from Glendale, California. A member of Schoenberg's old Apple gang, she discovered bulletin boards in mid-1982. "I had just gotten my computer. The bulletin boards help you learn the machine, make it more exciting and personal. I tried out a bunch. At first it was super neat, but the x-rated stuff turned me off after a while. There are too many weirdos out there. Then I heard about Marc. He had a nice tone and runs his board non-x-rated. Eventually the weirdos get discouraged."

She likes computer matchmaking because "you can get past the basics with a person, really get to know them." She's also made two or three close friends via modem since she first began calling. "I'm friends with a guy in Chicago. It's not flirtatious, it's just fun. I call another guy in Alabama sometimes. He's fun too, and real shy. We're good friends. I also have one real good romantic friend that I've met." She hasn't found any girlfriends on the system, but she has met other female callers at Schoenberg's gatherings. "Marc has real fun parties. That's one of the great things he does."

The Three to Five Grind. According to Lucia, it takes from three to five exchanges before she is sure she wants to correspond with a guy. If he sounds especially interesting, she might ask for his phone number. If all sounds promising between them, they might arrange to meet in person, then maybe go out on a date. Meanwhile, she keeps up her correspondence with other guys.

She also writes. "Marc said he's going to start up a story section and I'm trying to write one."

One disadvantage of computerized letter writing, according to Lucia, is that "you begin to form an ideal image of people from what you read. Then you feel pressured to like them in person. That's hard to take sometimes because they don't always measure up to your ideals."

Lauren42 is a professor at USC and a neighbor of Schoenberg; the latter asked her to log on to his Apple service when he was just starting. She doesn't own a computer, so she used his. "I thought it would just be fun, I wasn't looking for dates," she says, but she is now steadily dating the first man she ever corresponded with. "He started writing to me, and after a few weeks we exchanged phone numbers. We met for the first time in person at one of Marc's gatherings." She says he was just like she had imagined from his letters, although she liked him better in person. They hit it off instantly, and a week later began dating. That was three months ago.

"I still correspond with other people I've met on the service, both male and female. Some just want to chat, some like to tell you funny things that happened to them, some of the guys ask a lot of serious questions—they want to know all about you right away."

The anonymity of the computer tends to make correspondence braver and more honest than it might be in person, according to Lauren. Some people might be married, and some may not want others on the service to know they're dating. Some people are shy, and some have more than one code name, one for each split in their personality.

"I've met a lot of the people I've written to and they all turned out to be what they said they were on the computer," she says.

Wayne41 is the man Lauren has been dating since last Thanksgiving. He is an engineer for Lockheed in Burbank, California, and is also know as Matchmaker156, the operator of his own *Dial Your Match—DYM* number twenty-five, (213) 842-9452.

"Catch Me a Catch." Meeting people by computer was "kind of strange at first, but I was intrigued enough to start my own board." He didn't plan to meet anybody seriously when he started calling, around five months ago. Since then he's corresponded with a lot of "fun-loving girls and male computer nuts." Wayne says Lauren turned out to be much as he pictured in his mind's eye, only better. "A lot better," he adds.

Basically shy, he kept his first letter to Lauren along the lines of "Hi, this is what I do, who are you?" It wasn't until their first date that he realized the relationship had potential. Previously, he had dated another lady he had met via computer, but no magic had happened.

"You can't judge a person by words on a computer," he says. "Some people are honest, some are just blatantly weird. You can play out your fantasies, say what you normally wouldn't say, and so on. It's just like the CB syndrome. If people don't know who you are you can go crazy."

When Schoenberg relocated permanently in California last year, he didn't know anybody and had wanted to meet more intelligent people than you can do just hanging out. He also wanted to find a girlfriend. Bulletin boarding seemed the natural way to do it.

And in fact, as he shyly admits, he has been successful in this personal endeavor. The Martian has met his match. ▲

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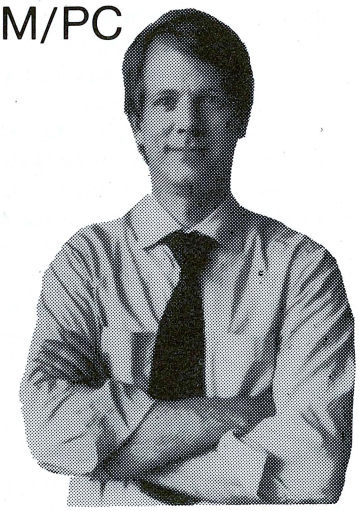

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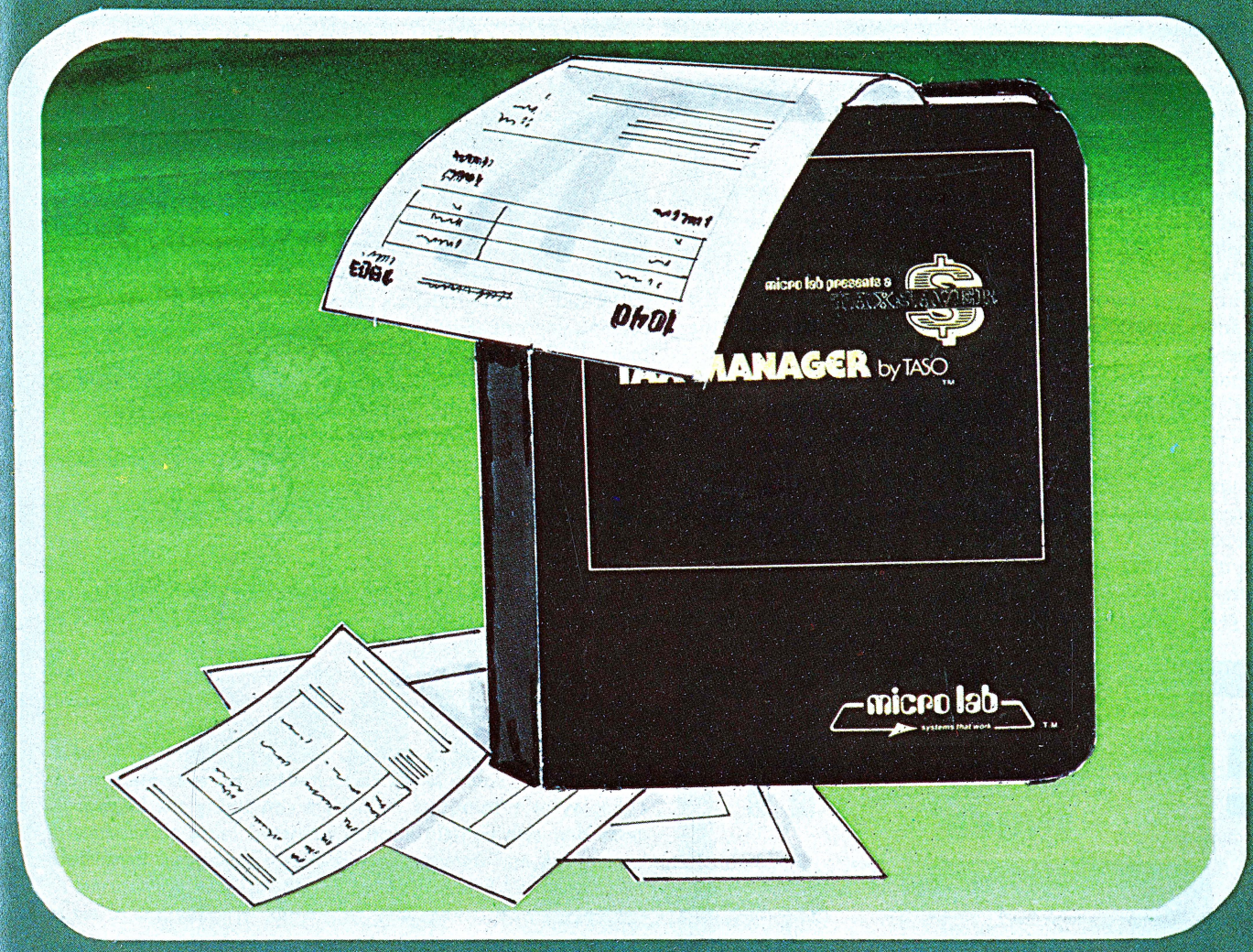

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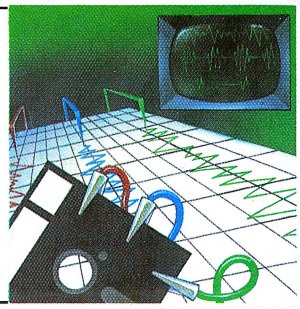

Unless otherwise indicated, software reviewed runs in DOS on machines with either display adapter and requires 64K and at least one disk drive.

DataFax. This is an unstructured, informal data manager, written in a runtime version of the UCSD p-System (you don't have to have the p-System to run it). Rather than using a predefined field and record method of organization, as most database programs do, *DataFax* arranges your information into pages and folders. A page is a screenful of data (twenty-three lines by eighty characters) or part thereof, and a folder is as many pages as you care to gather together under the same retrieval keys.

Information is indexed on disk by means of keywords that you designate. These words may be included within the text of your data or not, as you choose. You can specify as many keywords for a folder as you wish.

This approach to information management can be thought of as an automatically cross-referenced set of index cards—or a selectively self-replicating Rolodex file. It lacks some facilities commonly found in more formal database systems, such as the ability to perform computations based on values stored in certain numeric fields and the generation of reports derived from specific fields. On the other hand, the fact that you can begin typing information into the system as soon as you boot it up—without first having to envision the exact layout and categorization of your data—certainly has advantages in some applications. *DataFax* is ideal for such things as article research or ad hoc notes to yourself—in other words for those situations in which you can't foresee every category of information you'll ever need.

Moreover, there are ways to make *DataFax* behave in some respects like a formal database manager. For example, when you print folders, you can stipulate that only certain lines of each screen be printed. Thus with only a modest amount of planning you can produce an annotated mail list; just put name, address, and so on, within the top six lines of the screen, fill the rest of the folder with comments, history, or whatever—and select lines 1 through 6 of page 1 when you want to print mailing labels. Doing this is tantamount to generating a report based on selected fields.

All searching in *DataFax* is done by keyword. You specify either a single keyword or a group of them. Multi-keyword searches must, by default, satisfy all specified criteria; that is, the keywords *Jones* and *02134* together bring up only the Joneses living in that area code. But you can override this implicit logical *and* with a logical *or*. A logical *not* is, unfortunately, not available. The equals sign as the last character of a search criterion acts as a wildcard; *a=*, for example, brings up all folders containing keywords that start with the letter *a*.

It's also possible to do some sorting of reports in *DataFax*. By specifying *sort composer by bach...brahms*, for example, you can get a display or printout of all folders containing the keyword *composer* that also contain another keyword lying alphabetically between *Bach* and *Brahms*; Bach, Bartok, Beethoven, Berg, Berwald, Boccherini, and Brahms will then show up in the appropriate ASCII sequence, but Bruckner and Buxtehude will stay out of sight.

Two types of screen search are provided. One *scans* your database and displays only the first line of each folder found. From that list of first lines you can choose particular folders for full scrutiny. The other search mode brings up the complete folders directly.

Databases are limited to a single floppy disk (310 Pascal blocks), but utilities are included that allow transfer of selected folders from one disk to another, so it's relatively easy to split a full database in an orderly manner.

DataFax does not include calendar functions, as its competitor *VisiDex* does. You can't have it remind you automatically of that poker game on the third Friday of every month. You can use dates as keywords, however, and the program will sort them properly; 12/21/82 will appear before 11/19/83 in spite of its higher ASCII rank. As an agenda manager, *DataFax* is less convenient than *VisiDex*, but what it does it does more efficiently and with a lot more dispatch.

The fact that *DataFax* is written in the p-System means that it doesn't generate standard DOS files, so you won't be able to *type* your data from DOS or grab folders directly with your DOS word processor. But the program offers a utility to convert *DataFax* files to DOS and back. The other drawbacks to *DataFax*'s p-System orientation are that it doesn't run as fast as a program written entirely in assembly language and it may occasionally send you to the man-

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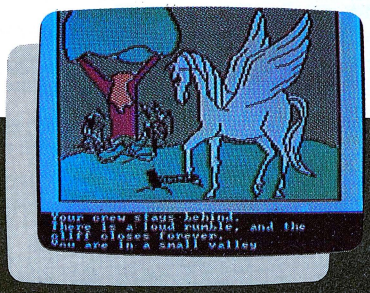

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ual to decipher an obscure p-System error message. But the programmers seem to have caught the most likely error conditions and put their messages into English, and as for speed, *DataFax* is by no means obnoxiously slow. It drags a bit when you're doing multi-key searches through a disk full of data, but then so does most everything else. **cs**

DataFax, by Curtis A. Bianchi and Rudiger V. Diezmann, Link Systems (1640 Nineteenth Street, Santa Monica, CA 90404; 213-453-1851). $299.

Microsoft Flight Simulator. By Bruce Artwick. Taxi to the end of the runway. Elevator okay. Rudder okay. Ailerons okay. Fuel okay. Full throttle. Pull back on the yoke. Wait a minute! Wrong mode! What's that Fokker doing there?!

Welcome to the most sophisticated flight simulator program ever implemented for a microcomputer. "Sophisticated" means realistic, big, and challenging.

Realism crowds the screen. The program is based on the Cessna 182, a popular, single-engined plane. The twenty-eight instruments on the display include every basic type, such as the altimeter and the airspeed indicator. In addition, there are instruments, like the OMI and transponder, that might seem mysterious even to a student pilot. They all work the same way they would on a real airplane. No matter that the computer could easily simulate a digital altimeter, a classic clock altimeter is what you get on the screen.

There is no joystick, but the keyboard manages to give the feel of real airplane controls. If you have problems with this program, they'll probably be due to the realism, not because of any flaws. For example, if you pull back too hard on the yoke, you will hear the stall warning, as you would on any plane. And if you keep pulling back, well, it's not the program that's out of control, it's the airplane.

To keep the detail from intimidating beginners, the "easy flight" mode eliminates annoyances like having your carburetor ice up or your lights burn out. There are other modes. You can fly in day, night, or dusk; in good, bad, or moderate weather; in any season; with one or two layers of clouds; with any kind of wind; and in simulated emergencies. There are twenty-two airports, scattered in four regions—New York/Boston, Chicago, Seattle, and Los Angeles. It is possible to fly cross-country, taking off in Boston and landing (eventually) in Los Angeles. (However, unless you are in the easy flight mode, you will run out of fuel first.)

In some ways, using *Flight Simulator* is harder than flying a real plane. The graphics are very smooth, and if you have a color composite monitor you will appreciate the programmer's talent, but there just isn't much scenery out there. Also, a computer cannot possibly simulate the inertial forces that tell even a blind pilot whether he is in level flight or a hard right bank. So the best we can do is simulate a nearsighted pilot with a bad case of vertigo. But even that is better than anything else that's been implemented on a microcomputer.

Unfortunately, the British Ace game, which might have been the centerpiece, ends up being a footnote to the rest. The realism so evident in the program somehow slips a gear when you crank up your Sopwith Camel. There are instruments on the screen that weren't invented in 1917. Worse, you carry five bombs and are expected to make your bomb runs while dogfighting with six enemy planes. It is more than challenging, it is absurd. The best way to rack up points is to enter German territory at ten thousand feet and drop your bombs before the Boche can get within gun range. For a B-17, this would be a fine strategy. For a Sopwith Camel, it is silly.

Even if you discount the British Ace game, this is a helluva program. The Personal Computer is finally attracting people who can use it to its full potential. **fj**

Microsoft Flight Simulator, by Bruce Artwick, Microsoft (10700 Northup Way, Bellevue, WA 98004; 206-828-8080). Color/graphics adapter required. Composite color monitor recommended. $49.95.

VersaForm. By Joseph Landau. Some software applications are so obvious at first glance that you wonder that they weren't done eons ago.

VisiCalc was one of those applications. *VersaForm* is another.

Applied Software Technology bills *VersaForm* as a business forms processor. This is understatement on the scale of calling a Rolls Royce your basic transportation vehicle.

VersaForm aspires to become the all-purpose business program for all businesses. And it mighty nearly achieves that goal.

Author Joseph Landau, a former IBM employee, observed that paperwork, usually in the guise of forms, was a function attendant to almost every business transaction. Landau made one of those logical leaps that separate the men from the boys.

If filling out forms was a time-consuming concomitant to most business transactions, then a program that automated that process would make a significant contribution to office efficiency. Landau left IBM to develop such a program.

Using Pascal as his development language in an effort to ensure portability, Landau aimed for the then dominant Apple market.

A probably apocryphal tale goes that Landau actually met with John Couch, vice president of software development at Apple, and offered the project to the company. Supposedly, Couch replied that he had several software engineers already working on the concept. To which Landau, a believer in the power of the individual and the inefficiency of programming by committee, replied, "I see I have the advantage on you."

What makes the story even more precious is that Landau presented *VersaForm* to the Apple marketplace a full year before Apple's software engineers brought Lisa to market. Lisa is a machine dedicated to smoothing out paperwork functions—among other problems.

Landau has generally accomplished the goals he set for himself. No matter what the function of the form, *VersaForm* can get it filled

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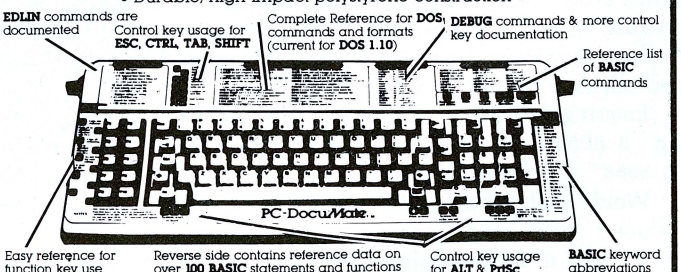

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out faster and more accurately. Be it sales order or invoice, purchase order or requisition form, expense report or confirmation order, *VersaForm* handles the chore with efficiency.

The various features of the program add up to a powerful tool, but as with most of the very powerful software tools, power comes at the price of what we euphemistically designate as user friendliness.

VersaForm is not overly complicated to install. On the other hand, its installation is neither trivial nor intuitively obvious. Usually a question can be answered by reference to the on-line help function or the excellent manual, but complicated applications may necessitate a call to the customer support service of Applied Software Technology. Such calls are answered promptly and accurately, enabling the user to proceed with little lost time.

For the most part, however, business forms processing can be converted to *VersaForm* with a minimum of fuss.

The design function, during which you adapt your form to the video display terminal, is a model of simplicity and power. The arrow keys on the numeric keypad provide quick and simple movement of the cursor anywhere on the screen. Entry of field labels and designation of field lengths are visual, simplifying the design process.

But the best attributes of the design function are in entry checking and automatic filling. It's here that the user can create an almost error-proof file.

After the screen has been designed and saved, each field is presented for review, with the program asking if the user desires checking or automatic filling. An affirmative answer delivers a new menu with a dozen or so choices.

You can restrict input in a field to numeric data, yes-or-no answers, and ranges of acceptable data. Minimum and maximum entry lengths can be designated. You can specify that it's mandatory to enter something in a field rather than leaving it blank. You can restrict legal entries to a list that you define. The program even offers a checksum facility to verify accuracy or data.

Or you can have the program fill in some of the data for you. It will, upon your specification, fill in today's date.

It will go out and search a look-up file for the correct entry to a field. This is a potent feature. *VersaForm* will handle up to ninety-nine look-up tables, each consisting of not more than ninety-nine entries. Consider an order form in a business that uses part numbers. Having entered the part number, the user could ask the program to go out to a look-up table to determine the product description. Voila! No more typing of product names.

VersaForm will also perform calculations. On the aforementioned order form, *VersaForm* could look up the unit price of the product, enter that in one field, then multiply the quantity ordered by the unit price to determine the extended price. The program will also calculate column totals upon request.

Entering data into such a form can be a delight. Instead of typing" 3 8088 microprocessors $64.00 $192.00", you merely enter "3 8088" and *VersaForm* will do the rest.

Would that the pc could do more work in such an automated fashion.

It's time to quit quibbling about the nature of the beast. *VersaForm* is a true database. Applied Software Technology steers away from that description because *VersaForm* is not oriented toward the kinds of tasks databases are customarily judged by. You can't sort five thousand items in three seconds. You can't use *VersaForm* as efficiently for ad hoc inquiries as you can such programs as *dBase II*, *VisiFile*, or *EasyFiler*.

Access to records is fairly speedy if you remember the correct key for the record. The key is determined by designating one or two fields as key fields. But if you forget the key, you're stuck with browsing. In a large file, that can be frustrating when you're in a hurry.

Even as *VersaForm* compares more than favorably with the usual database on the front end, it also fares well in matchups of reporting capability. In fact, the program can do almost everything except hand deliver a copy of a report to an interested executive.

There are no limitations as to which fields you specify or omit from a given report format. Nor is there any limitation as to where the fields are placed on the report. In a situation where the user is adapting an actual business form to the program, the report module will allow specification of exactly where each field will print in order to use the existing preprinted forms.

Exacting filtering techniques allow the user to get those records, and only those records, wanted. And a sort program allows the user to specify the order in which the records will be printed.

There are additional thoughtful little touches that make *VersaForm* an outstanding program. An on-line calculator is only a command away. It won't do trig functions or calculate satellite orbits, but it's adequate for the kinds of calculations that it's annoying to take pencil to.

Joe Landau was mighty near the mark when he conceived and executed *VersaForm*. It's a tool that can find a home in many departments within megabucks corporations and yet serve well in a small business environment. If paperwork is the bane of your existence, or of someone working in conjunction with you, *VersaForm* may be the best innovation since NCR paper. art

VersaForm, by Joseph Landau, Applied Software Technology (14125 Capri Drive, Los Gatos, CA 95030; 408-370-2662). Requires 128K and two 320K drives. $389.

PC Tutor. This is a two-disk tutorial on getting to know your pc, written for people who know nothing about computers. The major topics it covers are computer concepts, disks and their disadvantages, files and devices and how information is stored, DOS commands, PC-DOS utility programs, batch programs, function keys and special keys, and advanced programming commands. Each section is like an outline of a chapter in a book, with a few simple test questions at the end. Basically, you do an example of the action or function of the topic described.

You will have a better idea of what you're dealing with when you compute after having gone through the *Tutor*, but to get a really in-depth understanding of personal computering, you will have to go to the manuals. mf

PC Tutor, by Comprehensive Software Support, Comprehensive Software (Box 90833, Los Angeles, CA 90009; 213-370-6355). $79.95.

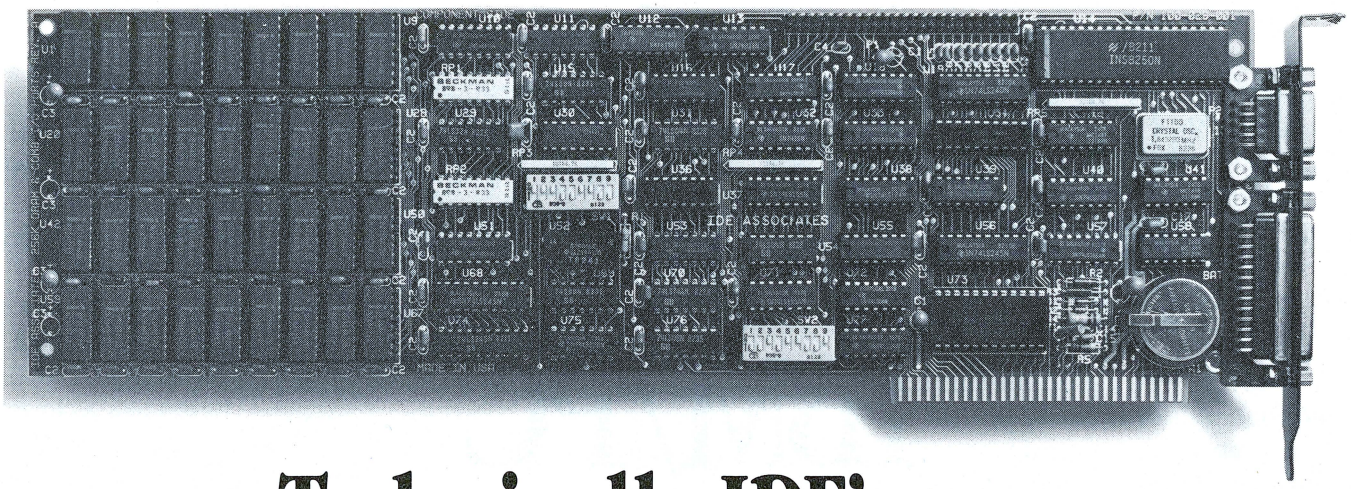
Chomps. By Howard Arrington. Disregard the knight and dragons on the cover. This is another version of *Pac-Man*, a bit different from the others. Because of its text-mode graphics, it can run with either the color or monochrome adapter.

Again, one sees the familiar, dot-strewn mazes, patrolled by wandering ghosts. In every corner is the predictable energizer, which allows you to glomp the ghosts. The difference from a typical *Pac-Man* maze is this—everything is text. Your happy-face *Pac-Man* is an ASCII character, and so are the ghosts. The walls of the mazes are ASCII lines; the dots are simply periods. The bonus dots that appear from time to time have a familiar look; they are simply the deck-of-cards symbols.

This approach to the game has its problems. The text mode allows only jerky animation, and the whole maze looks tiny on an eighty-column screen. However, the game has its strengths as well. There are four levels of difficulty and, as the game progresses, the animation speeds up to a rip-roaring pace. High scores are saved to disk separately for each level of difficulty. The color (if you have a color monitor) is quite attractive. The game can be played with either keyboard or joystick. Mercifully, the sound can be turned off.

There are better (and more expensive) versions of *Pac-Man* for the graphics board, but for monochrome, *Chomps* is a prize. fj

Chomps, by Howard Arrington, Ensign Software (7337 Northview, Boise, ID 83704; 208-378-8086). $29.95. ▲



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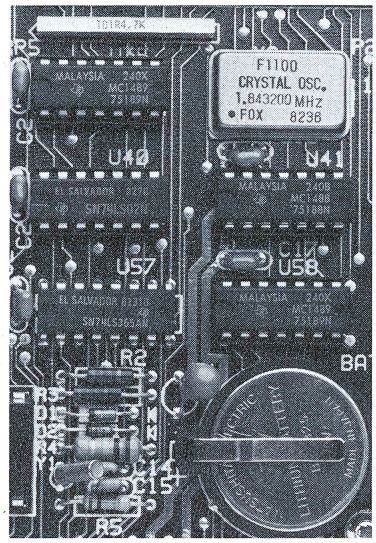

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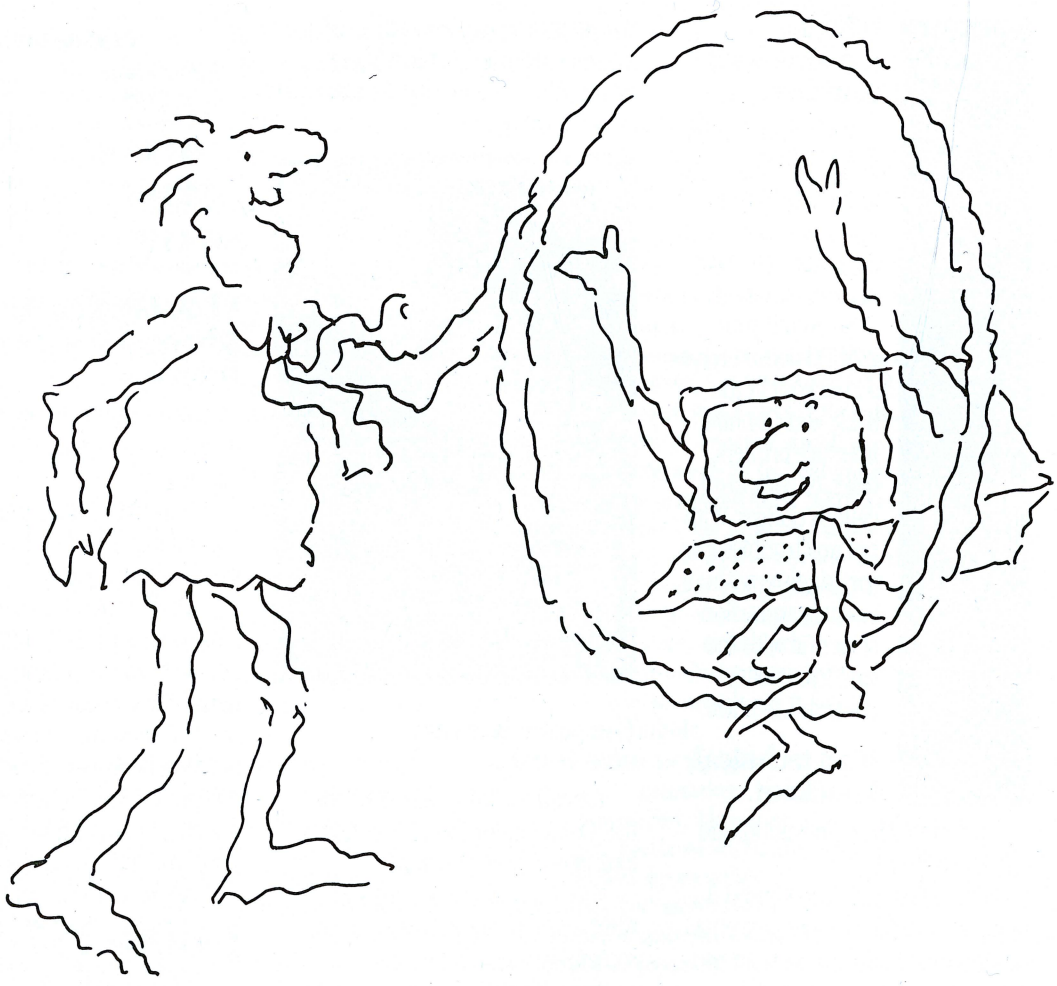

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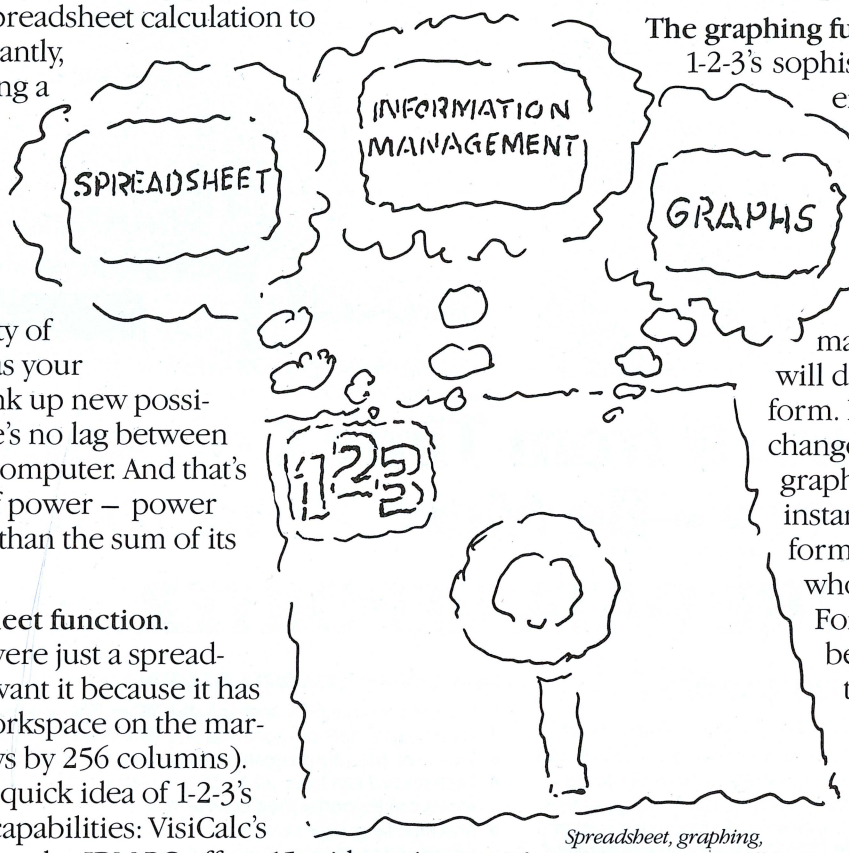

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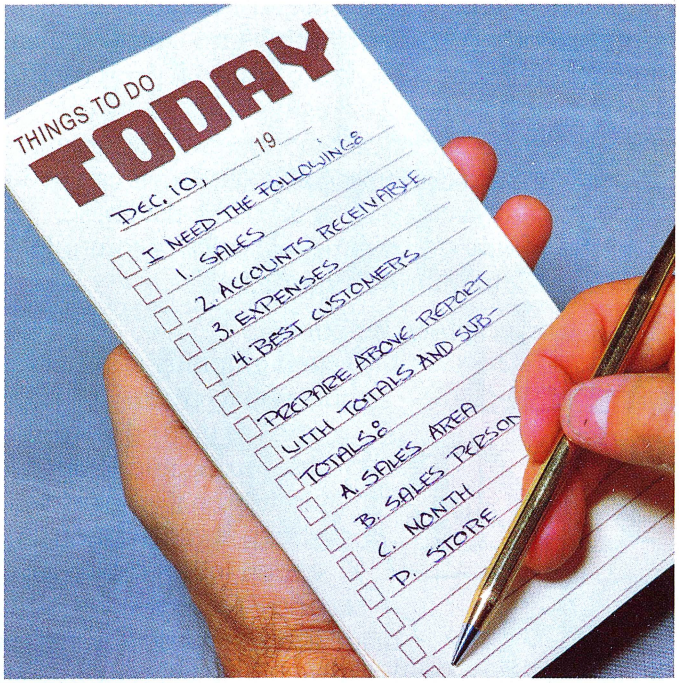
Monday 9:00 am



Monday 11:00 am

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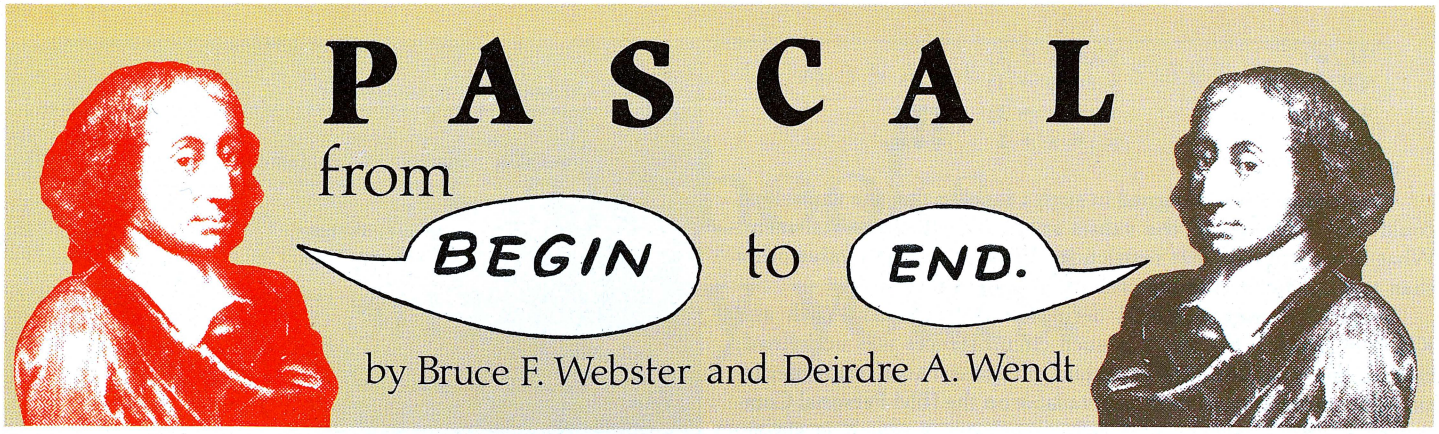

by Bruce F. Webster and Deirdre A. Wendt

Our last installment introduced the notion of control structures, explained a few fundamental related concepts, and discussed conditional and iterative constructs. In case you happen to have missed it, here's a compact summary:

A *control structure* allows nonsequential execution of statements in a program. A *statement* is the basic unit of executable code in a Pascal program; examples of statements include procedure calls and assignment of values to variables.

A *block statement* is a group of zero or more statements enclosed by the keywords *begin* and *end*; block statements can be used anywhere a single statement can. A *boolean expression* is one that resolves into a value of either *true* or *false*.

A *conditional execution construct* takes the form

```
IF < boolean expression >
   THEN < statement1 >
   ELSE < statement2 > ; (* optional *)
```

where *statement1* is executed if and only if *boolean expression* resolves to *true*. If the optional *else* clause is included, *statement2* is executed if and only if *boolean expression* resolves to *false*.

There are three kinds of *iterative constructs*. The first takes the form

```
FOR < var1 > := < expr1 > TO < expr2 >
   DO < statement > ;
```

or the form

```
FOR < VAR1 > := < expr1 > DOWNTO < expr2 >
   DO < statement > ;
```

This construct works as follows: First it sets *var1* equal to *expr1*. Then it tests to see if *var1* is equal to *expr2*. If it isn't equal to *expr2*, then *statement* is executed, *var1* is either incremented (*to*) or decremented (*downto*), and the test is made again. The variable *var1* may be of any scalar data type; scalar data types include *integer*, *char*, *boolean*, and user-defined enumerated data types. Variables of type *real* are not scalar.

The second kind of iterative construct looks like this:

```
WHILE < boolean expression >
   DO < statement > ;
```

The loop created by this construct will continue to execute *statement* as long as *boolean expression* resolves to a value of *true*. Like the *for* loop, the *while* loop tests the value of *boolean expression* before executing the statement; if *boolean expression* resolves to *false*, the statement is not executed.

The third iterative construct takes this form:

```
REPEAT
   < statement >
   < statement >
      .
      .
   < statement >
UNTIL < boolean expression > ;
```

This one differs from the others in two important respects. First, it can have any number of statements inside of it (so you don't have to use a block statement). Second, all the statements are executed at least once, regardless of the value of *boolean expression*. The test of *boolean expression* is made after each iteration of the loop, and the statements within the loop are executed repeatedly until *boolean expression* returns a value of *true*.

The Case Statement. When writing programs, we sometimes want to perform one of a number of alternative actions, depending upon the current value of a variable. For example, we might want a program to print out a menu, accept the user's choice, and then act in accordance with the user's choice. One way to accomplish this is by means of repeated *if..then..else* statements:

```
REPEAT
   write('Enter direction: U)p,D)own,L)eft,R)ight:');
   readln(ch)          (* ch is of type CHAR *)
UNTIL (ch IN ['U','u','D','d','L','l,'R','r'];

IF (ch = 'u') OR (ch = 'u')
   THEN y := y + 1
ELSE IF (ch = 'D') OR (ch = 'd')
   THEN y := y - 1
ELSE IF (ch = 'L') OR (ch = 'l')
   THEN x := x - 1
ELSE IF (ch = 'R') OR (ch = 'r')
   THEN x := x + 1;
```

However, the *if..then..else* chain can get a little tiresome (and difficult to follow) if there are a lot of different conditions to check. So Pascal includes an additional flow-of-control structure called the *case* statement.

The *case* statement requires a scalar variable that has been set to some value. The *case* statement has this format:

```
CASE < variable > OF
   < constant list 1 > : < statement 1 > ;
   < constant list 2 > : < statement 2 > ;
      .
      .
   < constant list n > : < statement n >
END;
```

where a *constant list* is a list, punctuated by commas, of constants of the same data type as the variable. When a program encounters a *case* statement, it compares the current value of the variable against each of the constant lists. When it finds a match, the program executes the statement corresponding to the constant list in which the match is found; the rest of the *case* statement then is skipped.

With the *case* construct, we could rewrite our complex *if..then..else* example as follows:

```
REPEAT
   write('Enter direction: U)p,D)own,L)eft,R)ight:');
   readln(ch)          (* ch is of type CHAR *)
UNTIL (ch IN ['U','u','D','d','L','l','R','r']);
CASE ch OF
```

```
    'U','u':            y := y + 1;
    'D','d' :           y := y - 1;
    'L','l' :           x := x - 1;
    'R','r' :           x := x + 1
  END;
```

This example was designed in such a fashion that the variable *ch* could only have one of the values specified in the *case* statement. What if we removed that restriction? What if *ch* had a value other than those listed in the *case* statement?

Under the original Pascal definition (by Niklaus Wirth and Kathleen Jensen), the result in such circumstances was undefined; that is, the outcome was uncertain. In most Pascal implementations, however (including those available on the IBM Personal Computer), a *case* statement that fails to achieve a match is simply skipped; execution continues at the first statement following the end of the *case* construct.

Some implementations, Microsoft's IBM Pascal among them, allow you to put an *otherwise* statement at the end of the list of *case* choices. This statement, if included, is executed only if the variable doesn't match any of the constant lists. With such an extension, we might rewrite our example in the following manner:

```
  write('Enter direction: U)p,D)own,L)eft,R)ight: ');
    readln(ch);
    CASE ch OF
      'U','u' :          y := y + 1;
      'D','d' :          y := y - 1;
      'L','l' :          x := x - 1;
      'R','r' :          x := x + 1
    OTHERWISE : writeln('illegal entry ')
  END;
```

Sample Program. Now that we've looked at all the different flow-of-control structures, let's put them together in a program. Figure 1 shows a simple Pascal program that uses all the constructs we've seen in this installment.

The first construct we encounter is a *while* loop. It tests the boolean variable *done* and loops as long as *done* has a value of *false*.

The next construct is a *repeat* loop. The statements in this loop prompt the user for a character. The program will not leave the loop until the user enters one of the valid command characters.

Within the *repeat* loop is our third construct, an *if..then..else* statement that tells the user whether or not a valid command character has been entered. Following this *repeat* loop is our fourth construct, a *case* statement. It takes one of six actions, depending upon the character the user has entered. Four of the possible outcomes of this *case* statement change the values of *x* or *y*. One command sets *done* equal to *true* and so allows the program to exit the *while* loop.

The remaining command ('F' or 'f') executes a block statement that contains our last construct, a *for* loop. This loop executes the statement *write(dot,bell)* five times (five is the value of the constant *firemax*).

Figure 2 shows a sample run of this program.

These control structures add greatly to the flexibility of our programs. They help us escape from the "every statement exactly once" approach to which we were limited in earlier examples. At the same time, they maintain a clearly defined path of execution through the code. By combining various control structures, we can create exactly the path we need.

Even with these aids, we're still limited in another way: if we need to execute a body of code in more than one place in our program, we're stuck with rewriting the entire sequence each time we want to use it. Our next few columns will present the ways around this limitation: *procedures* and *functions*. We've already used a couple of the standard Pascal procedures and functions (*writeln* and *chr*), without calling attention to them; from here on out we'll be able to write our own as well.

See you next time. ▲

```
PROGRAM example(input,output);
(*********************************************************)
(*                                                       *)
(*        example    sample Pascal program               *)
(*                   written to demonstrate control structures *)
(*                                                       *)
(*        author     Bruce F. Webster                    *)
(*        date       04 January 1983                     *)
(*                                                       *)
(*********************************************************)
CONST
  bellvalue                  = 7;
  firemax                    = 5;
VAR
  ch,bell,dot                : char;
  x,y,count                  : integer;
  done                       : boolean;
BEGIN
  done := false;
  x := 0; y := 0;
  bell := chr(bellvalue);
  dot := '.';
  WHILE NOT done DO BEGIN
    writeln('x,y = (',x,',',y,')');
    REPEAT
      write('CMD: L)eft, R)ight, U)p, D)own, F)ire, Q)uit: ');
      read(ch); writeln;
      IF NOT (ch IN ['L','l','R','r','U','u','D','d','F','f','Q','q'])
        THEN writeln('Illegal entry — try again')
        ELSE writeln('Command accepted')
    UNTIL ch IN ['L','l','R','r','U','u','D','d','F','f','Q','q'];
    CASE ch OF
      'U','u'      : y := y + 1;
      'D','d'      : y := y - 1;
      'R','r'      : x := x + 1;
      'L','l'      : x := x - 1;
      'F','f'      : BEGIN
                       write('Firing');
                       FOR count := 1 TO firemax
                         DO write(dot,bell);
                       writeln;
                     END;
      'Q','q'      : done := true
    END (* of CASE structure *)
  END (* of WHILE structure *)
END. (* of PROGRAM example *)
```

Figure 1.

```
      CMD: L)eft, R)ight, U)p, D)own, F)ire, Q)uit: L
      Command accepted
      x,y = (-1,0)
      CMD: L)eft, R)ight, U)p, D)own, F)ire, Q)uit: L
      Command accepted
      x,y = (-2,0)
      CMD: L)eft, R)ight, U)p, D)own, F)ire, Q)uit: U
      Command accepted
      x,y = (-2,1)
      CMD: L)eft, R)ight, U)p, D)own, F)ire, Q)uit: U
      Command accepted
      x,y = (-2,2)
      CMD: L)eft, R)ight, U)p, D)own, F)ire, Q)uit: R
      Command accepted
      x,y = (-1,2)
      CMD: L)eft, R)ight, U)p, D)own, F)ire, Q)uit: D
      Command accepted
      x,y = (-1,1)
      CMD: L)eft, R)ight, U)p, D)own, F)ire, Q)uit: F
      Command accepted
      Firing.....
      x,y = (-1,1)
      CMD: L)eft, R)ight, U)p, D)own, F)ire, Q)uit: K
      Illegal entry—try again
      CMD: L)eft, R)ight, U)p, D)own, F)ire, Q)uit:
```

Figure 2.

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THE PROFIT PLOT

by Jack Grushcow

This is the first of a series of articles aimed at showing retailers how to improve profit margins by means of a set of five interrelated electronic spreadsheets. Even if you're not a retailer, read a little further. The next two paragraphs tell you what future articles will be about. You'll also be directed to a questionnaire, so you can tell us what application areas interest you.

In coming months we'll be describing real world spreadsheet systems—systems that are in use by businesses today, systems that have directly contributed to increased profits and better operating efficiency.

This initial series is about retail profit control. If that doesn't turn you on, don't flip by yet. At the end of the article you'll find a brief questionnaire that gives you a chance to suggest topic areas of interest to you. If you take a minute to send it in, we can select topics in the future that better serve your interests.

Take a moment to cast your vote now! We can develop the spreadsheets you need. We'd like to do it for you, in your very own column.

Jack Grushcow is president of Consumers Software Incorporated, a company that designs and markets spreadsheet-based business packages. His latest book, The VisiCalc Applications Book, *is available from Reston Publishing Company. This article is based on ideas contained in that book.*

Better Profits through Inventory Management. If you're making a living as a retailer in today's economy, you have to be more concerned than ever about your gross profit margin. To a business that has sales of $1,000,000 a year, each percentage point drop in gross margin means a loss of $10,000 in profit.

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DATE	SUPPLIER	INVOICE#	INVOICE COST	TRANSPORT COST	LANDED COST	RETAIL VALUE	MARKUP
FEB 28	STUDIO 200	100	98.40		98.40	210.00	53.14
FEB 2	AMORELLI LTD	M109	945.35	5.90	951.25	2001.50	52.47
FEB 8	UNIVERSAL	20212	267.00	16.70	283.70	590.30	51.94
FEB 2	RUNNERS SHOE	RS 202	794.50	15.90	810.40	1680.25	51.77
FEB 11	PARIS SHOES	X-101	1290.22	14.98	1305.20	2680.50	51.31
FEB 1	ALPHA CORP	AK-101	400.20	10.00	410.20	830.00	50.58
FEB 28	AMORELLI LTD	M210	986.10	12.75	998.85	2000.00	50.06
FEB 11	STEP RITE	208	456.20		456.20	900.00	49.31
FEB 22	LONDON LTD	5908	789.34	23.10	812.44	1590.00	48.90
FEB 9	RUNNERS SHOE	RS 290	310.35	10.00	320.35	625.00	48.74
FEB 1	AMORELLI LTD	M101	1098.25	12.50	1110.75	2090.00	46.85
FEB 11	AMORELLI LTD	M115	870.00	24.90	894.90	1625.00	44.93
FEB 3	UNIVERSAL	20209	315.00	31.50	346.50	600.00	42.25
TOTAL			8620.91	178.23	8799.14	17422.55	49.50

Figure 1.

DISCOUNT REGISTER

CURRENT TO: FEB 28

DATE	ITEM	QUANTITY	SUPPLIER	OLD PRICE	NEW PRICE	DIFFERENCE	EXTENSION	COMMENTS
FEB 10	MENS RUNNERS	10	RUNNERS SHOE	52.98	44.95	8.03	80.30	
FEB 10	LINED BOOTS	12	PARIS SHOES	25.95	19.95	6.00	72.00	LAST WINTER'S
FEB 10	SLIPPERS	5	ALPHA CORP	15.98	9.98	6.00	30.00	
FEB 15	SANDALS	15	STEP RITE	12.98	9.98	3.00	45.00	
FEB 15	OXFORDS	15	LONDON LTD	45.95	32.95	13.00	195.00	
FEB 15	MENS RUNNERS	10	RUNNERS SHOE	39.95	24.95	15.00	150.00	
FEB 15	L. RUNNERS	15	UNIVERSAL	44.98	32.75	12.23	183.45	
FEB 15	WORKBOOTS	5	PARIS SHOES	50.95	24.95	26.00	130.00	
FEB 27	MENS RUNNERS	10	RUNNERS SHOE	43.95	22.98	20.97	209.70	
FEB 27	HIKERS BOOTS	8	ALPHA CORP	38.49	29.95	8.54	68.32	OLD STOCK
FEB 27	MENS RUNNERS	10	AKME	43.75	22.95	20.80	208.00	
FEB 27	SANDALS	15	STUDIO 200	14.98	10.99	3.99	59.85	NEW STYLE CAME IN
FEB 27	LINED BOOTS	12	STUDIO 200	88.90	56.98	31.92	383.04	
TOTAL							1814.66	

Figure 2.

which suppliers are contributing profits and which deliver goods that often end up in the discount bin. If margins are decreasing, the RIM will not only alert you; it will pinpoint the problem so you can do something about it.

What's in the RIM for You? If you follow the steps needed to keep the RIM up to date, you can begin to reap the benefits of some very important information. Some of these benefits include:

- Complete records of supplier profitability
- Complete records of product line profitability
- A month-end income statement
- A detailed record of discounts
- A monthly tally showing current inventory value

To whet your appetite for more details, some of the reports you can get from using the spreadsheet RIM system are shown in figures 1 to 3. Figure 1 displays a report that records all additions to inventory at cost and retail. The sample uses the new *SuperCalc2* package, and the markup column has been sorted from largest to smallest. This report lets you see which of your suppliers is providing you profits and which is not.

The next report, figure 2, shows a record of discounts for the month and lets you see which of your suppliers is costing you the most money in discounted inventory. This sample spreadsheet uses *VisiCalc;* entries appear exactly as they were entered into the sheet.

ACE RETAIL COMPANY

INCOME STATEMENT FOR FEBRUARY 1983

			PERCENT OF SALES
SALES		$ 23550.00	100.00
COST OF SALES			
COST OF GOODS	14671.65		62.30
DISCOUNTS	1130.22		4.80
SHRINKAGE	186.90		0.79
TOTAL COST	15988.77		67.89
GROSS MARGIN		$ 7561.23	32.11
OTHER INCOME		0.00	0.00
TOTAL INCOME		7561.23	32.11
EXPENSES			
ADVERTISING	200.00		0.85
AUTOMOBILE	278.25		1.18
BANK CHARGES	10.50		0.04
BAD DEBTS	0.00		0.00
INTEREST	235.90		1.00
RENT	900.00		3.82
OFFICE SUPPLIES	124.45		0.53
TAXES AND LICENSES	55.90		0.24
UTILITIES	120.15		0.51
WAGES AND BENEFITS	2000.00		8.49
OTHER	0.00		0.00
TOTAL EXPENSES	3925.15		16.67
NET INCOME		$ 3636.08	15.44

Figure 3.

The next time a supplier increases prices, or the next time it's time to buy more of his stock, you can make the right buying decision, based on information gained from this report.

If you use the RIM you will also be able to create a monthly income statement (figure 3). Your banker is bound to react more favorably to your borrowing needs when he sees the type of controlled business environment in which you operate.

How Does It Work? The main task of the RIM is to keep track of what your inventory is worth, both at cost and at retail.

Your inventory value follows a closed loop. It grows as it is fed new stock and shrinks as sales, discounts, and shrinkage occur. If you know what you have at the beginning and you keep track of all additions and reductions to the inventory value, you will always know your current inventory value.

The simple premise that makes the RIM work is:

Opening Stock + Additions To Stock
– Reductions To Stock
= New Inventory Value

This is the RIM golden rule.

As we develop our series of spreadsheets, we'll use a sample shoe store as our test case. But first let's look at how these spreadsheets work and at what each contributes to the overall RIM system.

RIM Overview. Control of your profits begins at the point where inventory enters your store. The first sheet in our system is called the *receiving sheet.* This is used to record key information about stock as you receive it.

When each shipment comes in, the date, supplier, shipment, cost, and transportation cost will be entered directly into the receiving sheet. Next, the retail value of the shipment and the markup percentage will be calculated. As the month goes on, the receiving sheet will track all additions to your inventory, both at cost and at retail.

The receiving sheet gives us the *additions to stock* portion of the RIM golden rule.

The second sheet in the system is the *discount sheet* and is used to record stock discounts as they occur.

Whenever stock is discounted, the date, item, and number of items to be marked down are entered into the discount sheet. The supplier, new price, and old price of the goods are also typed into the spreadsheet. The discount sheet will then automatically calculate the price difference and extension (the number of items discounted mutliplied by the price difference).

At the end of each month, all decreases in the value of the inventory caused by discounts and any increases caused by additional markups will be shown in the discount sheet.

The discount sheet helps provide the *reductions to stock* portion of our RIM equation.

The next step in the process is the *inventory tally sheet.* This one tells the ongoing inventory story.

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In order to begin using the RIM a physical inventory has to have been taken. You need to know the initial value of your inventory, both at retail and at cost, before you can begin monitoring changes to the inventory value. This step provides the initial *opening stock* portion of the RIM equation.

At the end of each month you will transfer the totals from the receiving and discount sheets to the appropriate cells of the inventory tally sheet.

The inventory tally shows all additions and reductions to the inventory at both retail and cost for the month. The new opening inventory for the next month can be calculated from these values.

You'll find that the inventory tally sheet will yield some very interesting information.

Because this sheet is fed by your monthly receiving sheet, it will report how the profitability of your inventory is changing.

Suppose, for example, that you're retailing produce. Your inventory at the start of a given month has a specific value at retail and cost. The difference between these costs is a measure of how profitable you can be when you sell your inventory.

At the end of the month you will have sold some of your inventory and will have received some new inventory. This new inventory will have its own value at retail and at cost. It has its own gross margin, which will probably be different from the gross margin of your total inventory. Adding new inventory will change the profitability of your total inventory. The inventory tally sheet will let you monitor these changes in the profitability of your inventory.

Suppose that at the end of the month your inventory had a value of $120,000 at cost and $200,000 at retail. If you could get $200,000 by selling your entire inventory, you would calculate your gross margin as follows:

Gross Margin = Sales
– Cost of Goods Sold
= $200,000 – $120,000
= $80,000

A more meaningful figure would be margin as a percent of sales. We calculate this as follows:

% Margin = (Gross Margin / Sales) * 100
= ($80,000 / $200,000) * 100
= 40%

Suppose that during the month you spent $9,000 on new stock that had an attached retail value of $13,000. The gross margin for these goods would be $4,000 ($13,000 – $9,000) and the percent margin would be ($4,000 / $13,000) * 100, or 30.7 percent.

This lower margin would affect the overall profitability of your inventory. When you add this new inventory, which contributes a lower margin, your inventory reflects this less profitable month of purchasing.

Examine these calculations:

New Inventory at Cost
= $120,000 + $9,000
= $129,000
New Inventory at Retail
= $200,000 + $13,000
= $213,000
Percent Margin = ($213,000 – $129,000)
/ $213,000) * 100
= ($84,000 / $213,000)
*** 100**
= 39.4%

So the reduced margin in this month's purchases has reduced the overall inventory profitability by over half a percent. The inventory tally sheet will alert you to such erosion of your profits.

So far we have recorded incoming stock and discounted stock, and we've forwarded this information onto the inventory tally sheet in order to keep up to date on how profitable the inventory is. The next step is to create a *margin budget report,* which measures profitability on a monthly basis.

The margin budget sheet uses the information contained in the inventory tally sheet to compare this year's results with last year's—on a monthly basis. This spreadsheet examines changes in sales, cost of goods, discount, and margin.

The margin budget lets you tightly monitor the key factors that affect your success as a retailer. If the margin begins to slip, the RIM will give you all the information you need to deal with the problem before it gets out of hand.

With a complete picture of the month's results, you can now take the final step in the RIM cycle. This involves drawing up your own income statement.

If you look back at figure 3, you'll see that all the information shown in the sales section of that statement can be obtained from the receiving sheet, the discount sheet, and the inventory tally. The income statement spreadsheet will have room for you to fill in your expense information for the month.

Once you combine all this information into the spreadsheet, you will have a complete record of your profit picture for the month.

Next month's article will demonstrate how to construct each of the spreadsheets in the RIM system. All the keystrokes necessary will be supplied. A detailed example will show you how to enter daily information into the sheets and complete the monthly RIM cycle at the end of the month. ▲

In order to serve our readers better, we've included the following brief questionnaire so you can tell us and *Softalk* which spreadsheet application areas interest you. If you take a moment to fill this out, we will do our best to deliver articles about applications that interest you.

Speak now or forever hold your peace.

Rank the following applications areas on a scale of 1 to 10: 1 indicates you have little or no interest and 10 indicates you are really anxious to see articles dealing with this application.

Cash Management	____	Credit Management	____
Payables Management	____	Portfolio Management	____
Forecasting	____	Retail Budgeting	____
Manufacturing Budgeting	____	Real Estate Investment	____
Job Costing	____	Time and Billing	____
Scheduling	____	Home Management	____
Financial Statement Analysis	____		

Other Suggestions: _____

_____

_____

I use the following spreadsheet programs(s):

_____

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Your profession: _____

I bought a spreadsheet program because _____

_____

SYSTEM NOTEBOOK

by Alan Boyd

As you may recall from last month's discussion, DOS keeps track of a disk's contents by assigning to each file an entry in a special table, called the *directory*. Each directory entry contains the following information about the file: its name and extension, its date and time of creation (or date and time of most recent update), its type, its length, and its *starting cluster*.

The file type is represented in the directory by an *attribute* byte. Currently only three types of files are available in DOS—normal, system, and hidden; updates of DOS will allow for other file types. The length of the file is represented in the directory as a number of bytes, or characters.

The directory entry also includes several bytes that are not used in the current revision of DOS. These bytes, each of which should be set to zero, are reserved for use in future expansions of the operating system.

We didn't get to the starting cluster last month; instead, we held off discussing that subject so that it could be put in better perspective. Before going any further, we need to look at this field to see how it relates to the rest of the directory entry. To do that we should first review some of the basics of operating systems.

DOS and Don't. One of the primary functions of a disk operating system is to manage the transfer of data between the computer's internal memory and the attached peripheral equipment. The most general case of a peripheral that's used to store data is the disk drive.

A good example of the data-transfer management performed by the operating system is the sequence of events that occurs when you enter an external DOS command at the command line interpreter. When you do this, DOS retrieves information from the disk and moves it into a location in memory. It then passes control to the program it has just loaded, thereby invoking your command.

The actual steps that DOS performs to achieve this relatively trivial result are extremely complex. First, DOS *parses* the command—it has to make sure the command you've entered is a valid statement. Then, if the command you have specified is not a recognizable internal command, DOS turns on the disk drive motor and positions the read/write head over the exact track and sector containing the disk directory.

DOS then scans the directory to see if the requested command is stored as an external command—that is, it looks for a .com file bearing the file name you've specified. If it finds such a file, it then ascertains the physical location of the file on your disk. Then it moves the head to that location and reads the information stored there into memory. Finally, it turns the disk drive motor off and passes control to the program it has just read into memory.

And even this description is an extreme simplification of the actual process.

All the complexities of this, the most simple DOS operation, are hidden from you. All you do is type a few characters and press the enter key; DOS takes care of the nasty stuff.

And although the writing of information from memory to a DOS file on disk is even more complex than the reading of information into memory, DOS performs this writing operation many times during the execution of such simple commands as *copy* or *sys*. In *copy*, for example, DOS first goes through the motions of reading information from a device, and then it writes it back out to the specified device—usually a disk drive. The write operation is also integral to such other functions as *erase* and *format*.

The first action that DOS takes when it receives a request to write information to a disk file is to allocate space on the receiving disk for the file. Space is allocated in units called *clusters*.

The cluster size depends on whether the disk used has been formatted to be single-sided or double-sided. On a single-sided disk, the cluster is one sector long, or 512 bytes; on double-sided disks the cluster is twice as large—two sectors, or 1,024 bytes.

A High FAT Diet. To keep track of which sectors have been allocated, DOS uses a table called the *file allocation table*, usually abbreviated as FAT. There's an entry in the FAT for every cluster on the disk; the contents of each cluster's entry tells DOS whether or not that cluster is currently in use.

The process of writing data to disk is as follows: DOS searches through the FAT until it finds a vacant cluster. It then writes data to that cluster and marks the entry in the FAT so that it will henceforth know that cluster is in use. If more than one clusterful of information is to be written, DOS continues through the FAT until it finds the next available cluster; then it writes data to that cluster, continuing in this manner until all the information has been written to the file.

Since the operating system cannot allocate partial sectors, some redundancy may result from this method; a file that's three and a half clusters long will essentially waste half a sector's worth of storage on disk (the redundancy will tend to be greater on double-sided disks than on single-sided ones, since the cluster size for these is twice as large). But this storage scheme has the advantage of allowing DOS to maintain the FAT in a very small amount of disk space; the compactness of the FAT makes for improved access speed.

A standard single-sided disk drive makes a total of 313 sectors available for file allocation. This number is derived by subtracting the number of sectors that DOS reserves for the boot record (one), the directory (four), and the FAT (two) from the total of 320 sectors created when you format your disk. Seven sectors are always in use by DOS (whether or not you have the two system files,

Ibmbio.com and Ibmdos.com, on your disk) and are therefore never free for allocation; hence there's no need for their representation in the FAT.

The remaining 313 clusters on a freshly formatted single-sided disk are free for file allocation. These clusters are numbered 2 through 314.

The reason the numbering doesn't start at 0 is that the first two allocation units in the FAT are used to store a code that indicates to the system what type of disk drive you have. DOS has to know the type of drive (single-sided or double), so that it can determine the appropriate cluster size; having this information stored in the first two FAT entries seems like a reasonable approach.

The drive type is stored as a three-byte code. Three bytes are twenty-four bits; hence a total of two to the twenty-fourth power different types of device can be interfaced by this method.

For a single-sided disk drive, the code is FEFFFF (hexadecimal). Dual-sided drives are coded as FFFFFF.

Out of the FAT, into the Fire. From this information you may have concluded that DOS stores two FAT entries in the space of three bytes. That's entirely correct. Awkward though it may seem to the nonprogrammer, DOS records each FAT entry as a twelve-bit, one-and-a-half-byte, number. For the sake of compactness it crams two of these entries into a three-byte block.

Multiply 313 by one and a half and you'll find that the 313 sectors available on a single-sided disk require 470 bytes of FAT. Add to this total the three bytes required to hold the disk type code, and you can see that the entire FAT fits comfortably within a single 512-byte sector. Working backward from the total of 512 bytes available for the FAT, you can quickly deduce that there is really enough FAT space for 340 entries.

Double-sided disks actually have a few additional two-sector-long clusters available, since the space required to hold the boot record, the directory, and the FAT is less than double the space required for these functions on a single-sided disk. Consequently, there are 315 two-sector clusters available for allocation on a double-sided disk. As on a single-sided disk, the FAT for a two-sided disk fits comfortably within a 512-byte sector.

DOS creates the FAT at the time you format your disk. It then writes the disk type code into the first two FAT entries and fills all the other entries with zeros. Therefore a free cluster—one that hasn't been allocated for file use—contains a zero.

When DOS receives a request to write data to a disk file, it looks through the FAT until it finds the first available cluster—in other words, until it finds an entry holding the value zero. The FAT entries, you'll recall, are numbered from 2 to 314 on single-sided disks and from 2 to 316 on double-sided disks. DOS gets the number of the first FAT entry it finds holding a zero value; then it writes that entry number into the starting cluster field in the directory. In this manner, DOS records in the directory the location on disk from which it can subsequently retrieve the file.

Having stored the appropriate starting-cluster number in the directory, DOS proceeds to write information into the disk sector or sectors represented by that starting-cluster number. When that cluster is filled, DOS goes back to the FAT to find the next available cluster. Then it gets the FAT entry number for that next-available cluster and writes that value into the FAT entry that represents the starting cluster.

To put this into more concrete terms, let us suppose that at the time you ask DOS to write your file to disk the first entry in the FAT holding the value 0 is entry number 37. DOS will write the value 37 into the starting-cluster field of the directory. Then it will write the first cluster's worth of data in your file onto the disk sector or sectors represented by FAT entry number 37. Let us assume your file requires more than one cluster. Having filled the starting cluster, DOS goes back for another look at the FAT and finds the next zero value in entry number 38. DOS then replaces the zero held in entry number 37 with the value 38, thereby leaving a trail by which it can relocate your file when you want to read it back into memory.

49424D42	494F2020	434F4D06	00000000	00000000	00000060
A7040200	80070000	49424D44	4F532020	434F4D06	00000000
00000000	00000060	A7040600	00190000	434F4D4D	414E4420
434F4D00	00000000	00000000	00000060	A7041300	5F130000
464F524D	41542020	434F4D00	00000000	00000000	00000060
A7041D00	E80E0000	43484B44	534B2020	434F4D00	00000000
00000000	00000060	A7042500	B8060000	53595320	20202020
434F4D00	00000000	00000000	00000060	A7042900	5D020000
4449534B	434F5059	434F4D00	00000000	00000000	00000060
A7042B00	D8070000	4449534B	434F4D50	434F4D00	00000000
00000000	00000060	A7042F00	68060000	434F4D50	20202020
434F4D00	00000000	00000000	00000060	A7043300	71060000
45584532	42494E20	45584500	00000000	00000000	00000060
A7043700	00050000	4D4F4445	20202020	434F4D00	00000000
00000000	00000060	A7043A00	CD090000	45444C49	4E202020
434F4D00	00000000	00000000	00000060	A7043F00	58090000
44454255	47202020	434F4D00	00000000	00000000	00000060
A7044400	6F170000	4C494E4B	20202020	45584500	00000000
00000000	00000060	A7045000	80A30000	42415349	43202020
434F4D00	00000000	00000000	00000060	A704A200	802C0000
42415349	43412020	434F4D00	00000000	00000000	00000060
A704B900	80410000				

Figure 1.
DOS 1.1 Directory.

When DOS receives a request to read data from a disk file into memory, it searches the directory until it finds the entry for the specified file. It then performs a few housekeeping chores, such as determining if there is indeed enough memory available to hold the entire contents of the file. Then it looks in the starting cluster field and retrieves the number of the first cluster that contains the data it needs. It then goes to that cluster and reads the data.

Then DOS goes to the FAT entry for that cluster and retrieves the next cluster number from that entry. It moves to that cluster and simply repeats the operation, continuing in this manner until it finds a special code used in the FAT as an end-of-file marker. When it finds a FAT entry containing this marker, it knows that there's no more data to be read.

Complex though this may sound, it's a somewhat simplified description of the events that occur when DOS reads or writes data between disk and memory; but the description is highly representative of the actual processes.

An Example. Although it may be difficult to follow, a real-life example is in order here. Let's take a closer look at one of the files on a DOS disk. In fact, let's look at the file containing the external DOS command that prompted this entire extravaganza—the *chkdsk*

FEFFFF03	400005F0	FF078000	09A0000B	C0000DE0	000F0001
112001FF	4F011560	01178001	19A0011B	C001FFEF	011F0002
21200223	4002FF6F	02278002	FFAF02FF	CF022DE0	02FF0F03
312003FF	4F033/60	03FF8F03	39F0F[illegible]B	C0033DE0	03FF0F04
41200443	F0FF/560	04478004	49A0044[illegible]	C0044DE0	044FF0FF
51200553	40[illegible]5560	05578005	59A0055B	C0055DE0	055F0006
61200663	4[illegible]66560	06678006	69A0066B	C[illegible]66DE0	066F0007
71200773	[illegible]077560	07778007	79A0077B	C00[illegible]DE0	077F0008
81200883	40088560	08878008	89A0088B	C0088D[illegible]0	088F0009
91200993					099F000A
A1F0FFA3					0AAF000B
B1200BB3					0BBF000C
C1200CC3					0CCF000D
D1200DD3					FFDF0003
E1200EFF					0EEFF0FF
F1200FFF					0FFF0010
01211003	41100561	1007B110	09A1100B	F1FF0DE1	100F0111
112111FF	4F111561	11FFBF11	19A1111B	F1FF1DE1	111FF1FF
21211223	F1FF2561	12278112	29A1122B	C112FF0F	00000000
F6F6F6F6	F6F6F6F6	F6F6F6F6	F6F6F6F6	F6F6F6F6	F6F6F6F6
F6F6F6F6	F6F6F6F6				

1 6F 2 02278002 3 FFAF 4

Figure 2.
The FAT for DOS 1.1.

command, which is stored in the file Chkdsk.com. If you have access to one of the various utilities on the market that allow you to examine the contents of each sector on a disk, then you may want to look in on the action for yourself.

When you issue a *dir* command, the file Chkdsk.com appears to be the third file on your DOS disk. However, if you examine the disk directory, by looking at track 0 sector 4, you will find that there are two hidden files located at the top of the directory. These are, of course, the hidden system files Ibmbio.com and Ibmdos.com.

Figure 1 shows the hexadecimal values that represent a portion of the directory for IBM's distribution disk of DOS 1.1. The highlighted area is the directory entry for the file Chkdsk.com. The first eleven values are the ASCII codes that represent the file's name and extension:

43	48	4B	44	53	4B	20	20	43	4F	4D	
C	H	K	D	S	K			C	O	M	♥

Note that DOS inserts blanks (represented in ASCII by the hex value 20) to fill the file name out to eight characters; note also that DOS doesn't need to store a period to separate the file name from the extension.

These first eleven values are followed by a null—the value 00. This is, of course, the attribute byte, and the null value stored here indicates that our file is a normal file.

There follows a string of ten more nulls, which are the reserved bytes in the directory entry. These bytes are not used in the current revision of DOS.

Following the reserved bytes are the two time bytes and two date bytes. For Chkdsk.com these bytes are 00 60 A7 04; if you care to decode them, you'll find that they translate to 12:00 p.m. 5/07/82.

Next in line are the two bytes that hold the starting cluster number: 25 00. We'll come back to these. And finally, we have four bytes—B8 06 00 00—that record the length of Chkdsk.com in bytes. This number translates to 1,760 bytes. A quick calculation will reveal that, since there are 512 bytes available for storage on each disk sector, the file Chkdsk.com occupies three full disk sectors and spills over into a fourth.

Now let's go back to the starting cluster number. We saw that there were two hexadecimal numbers stored there—25 and 00. For reasons beyond the scope of this discussion, these values are recorded with the least significant byte first, so they actually represent the sixteen-bit number 0025, which translates to 37 in decimal notation. This means that the first sector of the file Chkdsk.com is located in cluster number 37.

Figure 2 displays the FAT for the DOS 1.1 disk. To find entry number 37, we do the following. First, because each FAT entry occupies one and a half bytes, we multiply 37 by one and a half—and get 55.5. The entry we're looking for will be at byte number 55.5.

Each hex digit in figure 2 represents half a byte; the figure is thus laid out in groups of four bytes, with twenty-four bytes on a line. The numbering scheme starts at zero. On the first line of the figure are bytes 0 through 23, the second includes 24 through 47, and the last two hex digits in the second group on the third line hold byte number 55. This byte is said to be fifty-fifth *offset* into the FAT.

From the fifty-fifth and fifty-sixth offset we retrieve the hexadecimal values 6F and 02, which form the sixteen-bit *word* 026F (a word, in this context, is defined as two eight-bit bytes; and the numbers are stored least significant byte first). Since the FAT entry in question is an odd-numbered one (number 37), we only want the first one and a half bytes (twelve bits) of this value; thus, we're left with the hexadecimal number 026, which is equivalent to 38 in decimal notation. This number represents the location of the second cluster in the file Chkdsk.com.

Recall that our starting cluster was hex 025, or decimal 37. What we've seen therefore is that the first two portions of the file Chkdsk.com are located in consecutively numbered clusters.

We found the second cluster of the file by getting the starting cluster number from the directory and using that value (multiplied by 1.5) as an offset into the FAT. To find the third cluster, we take the second cluster number, multiply *it* by 1.5, and use *that* as an offset into the FAT. The second cluster was 38 (decimal); 38 times 1.5 equals 57; hence, our third cluster number will be stored at offset number 57 in the FAT.

At offset 57 we find the hexadecimal values 27 and 80, which combine to form the word 8027. Since we are dealing with an even-numbered FAT entry (FAT entry number 38), we discard the leading half byte, which leaves us with the value 027, equivalent to 39 in decimal notation. So, our third cluster turns out to be consecutive with the first two.

Repetition of this procedure reveals that the next chunk of Chkdsk.com is stored in cluster number 40 (hex 028). And further investigation shows us that FAT entry number 40 (offset number 60) holds the two hex bytes FF and AF, giving the hex word AFFF. Discarding the high-order half byte leaves us with FFF, DOS's marker for the end of file.

This scheme may seem a little strange and difficult to follow, but, of course, it's simple enough for a machine.

The number that DOS uses as an end-of-file marker for Chkdsk.com is hex FFF. This is actually one of eight codes available for this purpose; the others are FF8, FF9, FFA, FFB, FFC, FFD, and FFE.

The codes from FF0 through FF7 are also reserved by DOS as special-purpose FAT markers. For example, if a FAT entry contains the code FF7, then the associated cluster has been found to be unusable. This scheme is different from the method described in an earlier article. In version 1.0 of DOS, bad sectors were allocated in the FAT to a file named Badtrack. Under the newer scheme, the need to consume a directory for this purpose has been eliminated.

The method by which DOS erases a file from disk should now be quite obvious. It would be a time-consuming, inefficient process for DOS to go out to disk and physically eradicate the information from each sector of a deleted file. Instead, the system writes the standard *erased* mark (E5 hexadecimal) into the first byte of the directory entry (which formerly held the first character of the file name). Then it looks at the starting cluster field in the directory entry and proceeds to put zeros in all the FAT entries for the file, thereby adding them to the pool of clusters available for allocation. The next time DOS receives a write request, then, it can use the freed sectors and overwrite the data that was erased.

Deleting files can cause cluster allocation to be nonlinear. Imagine, for example, a disk that contains several files. If one more file is added to this disk, DOS will allocate the next free sectors to hold it. If next a file that was created earlier is deleted, then some clusters that are represented by lower numbers in the FAT will be freed for allocation. Then if you add another file, DOS will begin allocating clusters from the group that you just deleted—and these will most likely not be the next in line in the disk's physical layout.

Although nonlinear allocation is not a problem to DOS, it may become a nuisance to you, since it will cause the operating system to consume a little more time moving the read head around the disk to find the data. The remedy, as we saw earlier in this series, is to use the *copy* command (not *diskcopy*) to move all the files over to a new disk. This procedure realigns the files into a physically linear order, allowing them to be loaded or modified marginally faster.

How FAT Is It? We have seen how a FAT entry contains a twelve-bit binary code that represents the FAT entry for the next cluster. Twelve bits can represent any number from 0 to 4,095. The sixteen highest entries, however, are reserved for end-of-file markers and for other purposes. This leaves a total of 4,080 different possible FAT entries.

This number is significantly greater than the number of files (316) currently allowed on a double-sided disk. Obviously the scheme has been designed to allow FATs that are larger than a single sector in length. If the entire potential of the present FAT structure could be applied to a device that used two-sector clusters (1,024 bytes), then DOS's capabilities could be extended to a total of 4,080 times 1,024—or 4,177,920 bytes.

That may seem like an astronomical figure if you're used to working with floppy disks, but it's still not adequate for use with a Winchester disk. Obviously DOS's FAT structure will change as the operating system grows.

Extra FAT. One of the interesting features of DOS is that it always keeps multiple copies of the FAT around. Two copies are kept on each disk—on track 0 sectors 2 and 3. An additional copy of the FAT is maintained in the computer's internal memory.

Whenever the status of the disk is altered, the disk-resident versions of the FAT are updated. This doesn't present any problems, since the process of altering the status of a disk already requires a read or write operation to disk. Since the disk is already up to speed, DOS may as well update the FATs while it's out there.

DOS's method of allocating space and keeping track of the process through the directory and file allocation table is a vast improvement over the methods used by CP/M and CP/M-86. In these systems, disks cannot be freely removed from or replaced in the disk drives; instead, the user has to enter a control-C when changing disks. In CP/M if you remove a disk from a drive and replace it with another, without entering control-C, the operating system may overwrite the new directory with a copy of the directory from the old disk, thereby rendering the new disk useless.

DOS is smart enough to make sure that the data it holds in memory pertains to the disk in the drive, so that it doesn't trash your data. DOS lets you change disks at any time—with one obvious exception. Never remove a disk while information is being written to it; doing so could result in a situation where information is written to a file but the directory and FAT are not updated.

Problem FAT. There are a couple of ways in which your FAT can get messed up and cause you headaches. Luckily these circumstances will not arise if you use DOS in the normal manner and let it take care of all file housekeeping. If, on the other hand, you try taking liberties with the operating system and doing some housekeeping work yourself, you may come to regret it.

The two most common problems arise from the circumstance where a program fails to update a FAT properly. These problems create what are commonly called "widows" and "orphans," although they are better described as "popular" and "unpopular" FAT entries.

A popular FAT entry results when more than one file thinks that a FAT entry and its associated cluster belong to it. Obviously, this is an intolerable situation. This could arise from having the starting cluster numbers in two different directory entries pointing to the same FAT entry, or from having two FAT chains lead to the same entry. The cluster involved obviously contains data that's relevant to one of the files, but not to more than one.

The other type of malfunction, the unpopular FAT entry, occurs when an entry is marked as allocated but doesn't actually belong to any file. Under normal circumstances there is no way to use the cluster represented by this kind of FAT entry.

Finished? FAT Chance. This now brings us to the point at which we started at the beginning of last month's article. We were discussing that simple DOS external command, *chkdsk*. A quick glance at the IBM DOS manual may lead you to believe that this rather innocuous little command is used simply to report the status of the directory and file allocation table for the specified disk.

It actually does more than report, in a static manner, the status of directory and FAT; it modifies them if it finds an error. For example, if *chkdsk* discovers a FAT entry containing a number that's too large to represent a physical sector, it will set that allocation block back to its free state, so that it can again be used to store a legitimate file.

Another of *chkdsk*'s interesting efforts is directed toward the freeing of disk allocation units that are marked "in use" by the FAT but don't belong to any file. Such circumstances may arise if an application program doesn't obey the laws of DOS.

When applied to a normal disk, *chkdsk* returns a report that looks like this:

160256 bytes total disk space
8704 bytes in 2 hidden files
144384 bytes in 26 user files
7168 bytes available on disk

131072 bytes total memory
118672 bytes free

Chkdsk may also return a report that states
4096 bytes in bad sectors
if it discovers that certain sectors have been marked as damaged.

The command may also return one or more error messages, each of which indicates the existence of an abnormal condition. The current *chkdsk* error messages include

Allocation error for file filename
which indicates that an invalid allocation unit number was discovered in the FAT. *Chkdsk* "deallocates" the offending allocation unit and truncates the file at the end of the previous allocation unit. If the file contains a program, then this measure is futile, since the program has probably been rendered unusable. If, on the other hand, the file contains data, then some data is saved.

xxxxxxxx bytes disk space freed
This error message indicates that allocation units formerly marked as used, but not actually in use, have been "deallocated."

Directory error—file: filename
indicates that a directory entry was discovered for a nonexistent file. In other words, there were no allocation units assigned to this file. *Chkdsk* removes the bogus file from the directory.

Diskette not initialized
If *chkdsk* cannot find the directory or FAT, it assumes the disk has never been formatted. If this happens with a disk that you know *has* been formatted, first try to *diskcopy* the disk; if that fails, try to *copy* all files to a new disk. In most cases, this attempt will not be any good at all; but that's okay—you did make a backup, didn't you?

File size error for file filename
This error message is returned when *chkdsk* discovers that the size of the file as indicated by the directory entry doesn't agree with the actual size of the file, which it can calculate by counting allocation units. If this happens, *chkdsk* adjusts the figure contained in the directory entry.

Files cross-linked: filename and filename
When *chkdsk* emits this error message it means that it has discovered two directory entries that describe the same data block. A situation like this is not likely to arise (it can only be the result of a blatant error in an application program), but in any case it isn't lethal as far as data integrity is concerned, so *chkdsk* doesn't take any action. It leaves it up to you to correct—by copying both files to two different file names, then erasing both of the original directory entries.

In addition to these error messages, there are also the usual DOS error messages that may crop up from time to time. All of these are self-explanatory and easy to correct.

Thus ends our trek through the *chkdsk* command and its associated trivia. This should give you a better idea of how DOS keeps track of all the information you send to disk. Next month we'll take a look at how this information is actually stored on disk. ▲

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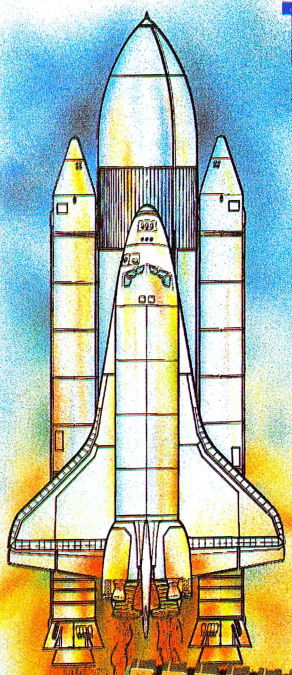

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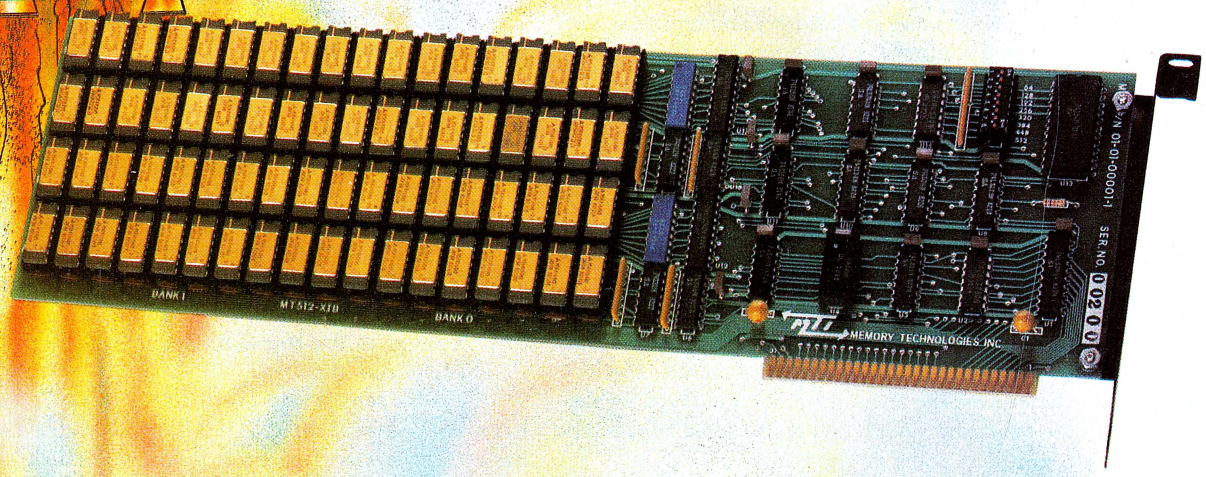

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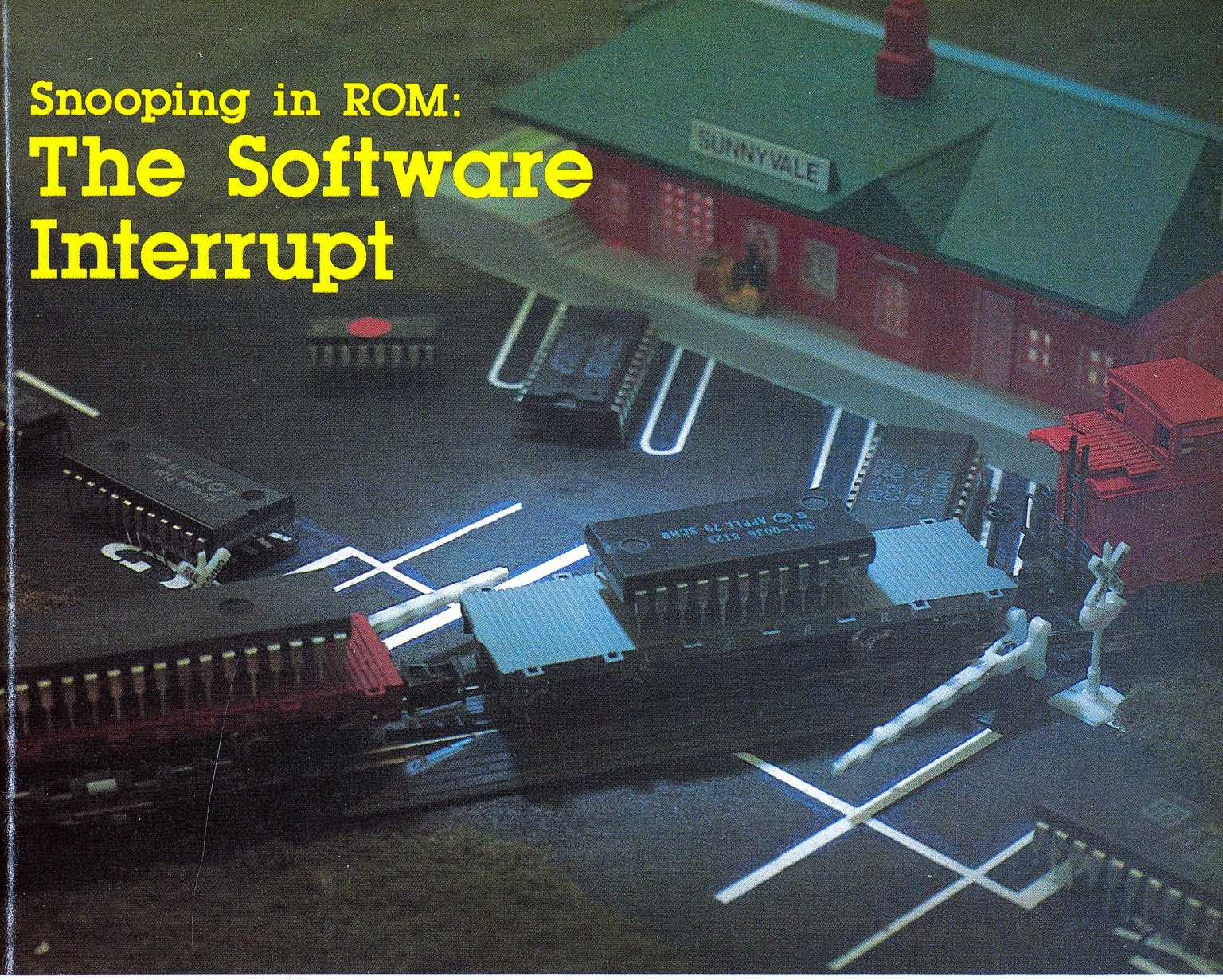
Snooping in ROM: The Software Interrupt



by Peter Norton

In the first two articles of this series, we started looking at the read-only memory (ROM) programs that are built into the IBM Personal Computer. The first article covered the locations of these routines and showed how to explore them. The second article discussed differences between the two versions of the ROM BIOS programs. To conclude this series on ROM, we'll see how the service routines are accessed, why they're accessed as they are, and how you can override the ROM programs.

The ROM BIOS programs are the heart of what it takes to make the pc work. They are permanently resident service routines, always ready to perform their tasks for any kind of program running on the pc. What makes it possible for any program to use the ROM routines is a feature of the pc known as a *software interrupt.*

To help you understand the ROM BIOS, let's look at the whys and wherefores of software interrupts.

If someone tells you to go to Chicago, get a pizza, then return and give a report on the quality of pizza in Chicago, you need to know how to get to Chicago and how to get back. Similarly, for a program to execute a subroutine—whether a ROM routine or any other—the program has to know two things: the address of the routine and the return address.

Don't Call Us. The traditional mechanism by which computers execute subroutines is known as a *call.* To call a subroutine your program has to know where the subroutine is. But the subroutine doesn't need to know in advance where your program is. That's because the computer's call mechanism automatically supplies the appropriate return address. In effect, the trip home is free.

The call mechanism is just dandy when your program contains within itself all the subroutines it needs to use and therefore knows exactly where each one is located. But what if it needs to use a subroutine that belongs to the computer system as a whole—such as one of the ROM BIOS subroutines?

This problem could be solved by having the computer manufacturer publish all the permanent addresses of all the public subroutines. But this is a lousy solution, for more than one reason. If you can get a free ride home by having the computer automatically generate the return address from a call, why not get a free ride going out by having the computer also generate the ad-

This article is taken from the forthcoming book, Inside the IBM/PC: Access to Advanced Features and Programming, *which will be published by the Robert J. Brady Company in the spring of 1983.*

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dress of the subroutine you want to use? This is the idea behind the software interrupt (hardware interrupts are another subject—to be covered at another time).

What we need is easy access to a list of ROM subroutines that are available to all programs. Instead of publishing a list of the memory addresses where these subroutines are located, your pc keeps that list to itself and just assigns access numbers to the various subroutines. One subroutine might be service number 10, another one service number 11, and so on.

To use service number 10, then, in our own programs, we don't *call* it; instead we perform software interrupt number 10. When we do that, the computer looks up the address of service 10 in its private table and passes control to the appropriate subroutine.

The advantage of this interrupt approach over the call approach is that the addresses of the routines don't have to be public knowledge. Also, their addresses don't have to be permanently fixed; only the service numbers have to be fixed.

Not having to have permanent addresses for the ROM subroutines gives the system flexibility. Suppose, for example, a change is made to one of the service routines—perhaps to fix an error or to add a new feature. Changes like that usually alter the size and location of the service routines. Under the software interrupt system, when such an alteration is made, the only other change required is in the computer's private table of service routine addresses; the service numbers remain as they were.

The software interrupt scheme has another advantage. Suppose one of your programs needs to replace a ROM service routine temporarily with your own customized version. This isn't an uncommon occurrence; it happens all the time. You can't change the ROM program itself, because it's in read-only memory. But if your programs are privy to the techniques used to make interrupts work, you can replace the address of a ROM program in the computer's private interrupt service table with the address of your own service routine.

If you want to understand why it might be desirable to customize a ROM routine, consider this example. An increasingly popular option to install on pcs is what's called an electronic disk or RAM disk. This is a large amount of memory set aside to act like a very fast disk drive. How could you write a program to make a RAM disk work?

Well, suppose the RAM disk is to be called drive C, while drives A and B continue to be the usual floppy disk drives. The program that makes a RAM disk work puts its own address in the interrupt table for all the disk services. When the new routine is activated, it checks to see which drive is being used; if it is drive A or B, control is passed to the old disk routines. If the request is for the new RAM drive, drive C, then the special routine does its thing. By this technique, you can add a new service onto the front of an old one, without disturbing the operation of the old one.

The private table of addresses for interrupt routines is properly known as the interrupt vector table; the *vectors* are the addresses of the program routines that perform the work for each kind of interrupt. This table is kept at the very beginning of the pc's memory. Each interrupt vector is four bytes long, so you can find the location of an interrupt vector by multiplying its service number by four. Interrupt 0 has its vector kept at memory location 0, interrupt 1 at location 4, and so on. The interrupt table is kept as big as necessary for however many interrupts have been defined.

The Interrupt Hierarchy. As currently defined, the pc interrupts fall into several categories, according to who reserved them and for what purposes. There is something of a hierarchy governing the use of interrupts, which you'll see now as we go through them.

The first five interrupts, numbers 0 through 4, are used for special purposes designed into the Intel 8088, the microprocessor that's the pc's brain. Intel, as designer of this microprocessor, got first dibs on interrupts. These first five handle such things as division by zero, arithmetic overflow, and some other special needs.

The next batch of interrupts, numbers 8 through 15, were designed by IBM as hardware interrupts, to handle the requirements of equipment that must call for attention by means of interrupts. For example, each keystroke on your keyboard causes an interrupt number 9.

After IBM's set of hardware interrupts come IBM's software interrupts for accessing ROM routines. These routines mostly use interrupts 16 through 31.

Two of the interrupts in this group are especially interesting because they are left open for us to fill in. One of these open interrupts, number 27, is invoked whenever the break function is used on the keyboard (that is, whenever control-break is pressed). The other, number 28, is invoked with every tick of the interval clock—about ten times a second. Both of these interrupt vectors are set by the system to point to a do-nothing routine. However, if your programs replace the vector with the address of an interrupt handling routine, then your routine can take charge of the computer whenever a break or a clock tick occurs. These two interrupts were set up by IBM to provide us with easy access to the two control access points that we were most likely to want.

After these fixed software interrupts can come anything, but there is a standard use

for the interrupts that follow. The operating system and the built-in Basic have a block of interrupts they use, and another block is set aside for our use, should we need them. Interrupts 32 through 63 are reserved for the operating system. PC-DOS uses 32 through 39 and could make use of 40 through 63 in the future. Interrupts 64 through 127 are available for us to use. Basic finishes off the set; numbers 128 through 133 are permanently reserved for Basic, and the Basic Interpreter, when running, can also use 134 through 240.

Considering now the service routines in the ROM BIOS, the interrupts of interest to us are the BIOS entry points, interrupts 16 through 26. But before we get to them, there is one more interesting sidelight. ♥

Decoding the Table. The interrupt vector table is intended to hold the addresses of interrupt service routines. But IBM extended the idea a little, in an interesting way. In addition to the interrupt handling routines, the interrupt vector table on the pc also holds addresses of some important data tables. These addresses are stored in the vector table just as if they were program addresses—which they aren't. For each of these data table addresses there is a corresponding interrupt that can't be used.

There are three of these key table addresses. The first, corresponding to phantom interrupt 29, gives the address of the video initialization table, which holds the start-up control codes for the display screens. This table is located in ROM at address FF0A4, and you can inspect its cryptic coding by looking at Appendix A of the *Technical Reference* manual.

The second table address, corresponding to interrupt 30, points to the disk parameter table. This information controls such things as the time allowed for various disk functions. The built-in version of the table is in ROM at address FEFC7. One change made between DOS releases 1.0 and 1.1 was to override the table in ROM with another set of values; the change has the effect of speeding up disk access. DOS 1.1 sets up the replacement table in regular memory and changes the interrupt vector to point to the new table.

The third table address, corresponding to the unusable interrupt vector 31, points to the graphics generator table for the high-byte codes 128 through 255 (hex 80 through FF). This table doesn't exist; it's an add-on possibility for you to use. The uses for this table are very intriguing, and we'll save discussing that for another time.

Accessing BIOS. With all that preparation out of the way, let's look at the specifics of accessing ROM BIOS.

While each routine in ROM BIOS is accessed by an interrupt, not each one has its own separate interrupt. There would be too many interrupts if each routine had its own unique one. Instead, logically related routines are grouped into categories, with several routines sharing one interrupt; the specific operation within a group of related routines is indicated by a function code placed in one of the computer's registers.

A moment's thought will convince you that the number of different interrupts used to provide ROM-BIOS access is arbitrary and there is no compelling reason one interrupt couldn't serve for all the routines—or why any number, large or small, of interrupts couldn't have been used. There follows a brief table of the interrupts that were chosen for ROM-BIOS access.

That's about all there is to say in a general way about the ROM BIOS programs. The only thing left is to go into detail about each of the service areas. Now, at least, you have a good starting knowledge of what ROM on the pc is all about. ▲

Number	Hex Code	Purpose
5	5	Print-screen operation
16	10	Video I/O; that is, display screen operations
17	11	Equipment check; used to determine what equipment is attached
18	12	Memory check; determines memory size
19	13	Disk I/O; numerous disk operations
20	14	RS-232 I/O; operations for the asynchronous communications adapter
21	15	Cassette I/O
22	16	Keyboard I/O
23	17	Printer I/O
24	18	Not a service routine; invokes cassette Basic
25	19	Not a service routine; causes system reboot
26	1A	Time of day and date functions

Table 1.

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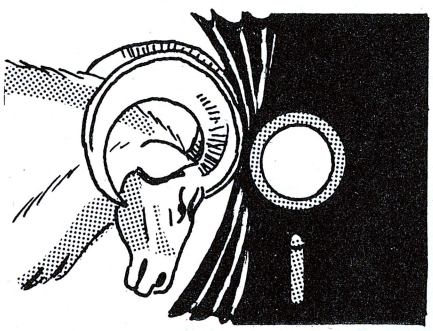

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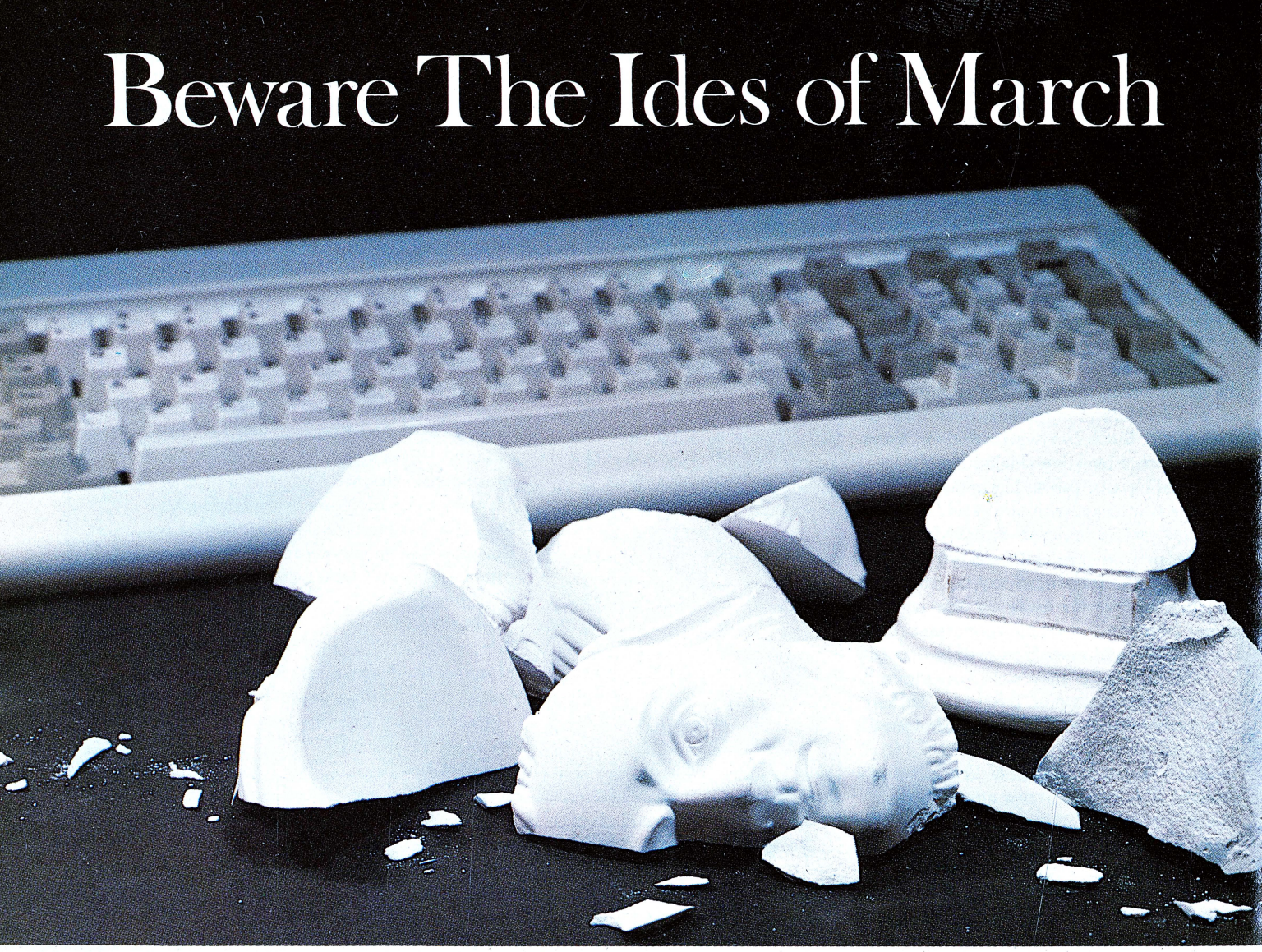

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by Joe Juhasz

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and we'll mail it to you on a disk. Included on the disk will be the program in its fully commented form, as shown here, along with a faster running compressed version (comments removed) and a much speedier compiled version.

This program accepts as input a Basic or Advanced Basic program that has been saved in ASCII format, by means of the command *save"Program.bas",a.* As output it generates a listing of the input program's variables, accompanied by the line numbers in which each variable is used.

A cross-referenced listing is most useful during program development or debugging, or when you're looking for ways of improving program performance.

For example, suppose that you've made a typo in a variable name. Basic does not require you to declare your variables in advance the way Pascal does. So if the Basic interpreter comes across a variable called *filenaNe$,* and that variable hasn't been used before in your program, the interpreter will just go ahead and create a variable of that name for you—and not concern itself with the possibility that you may have intended to type *filenaMe$.*

This kind of error can be a little hard to find without the assistance of a cross referencer.

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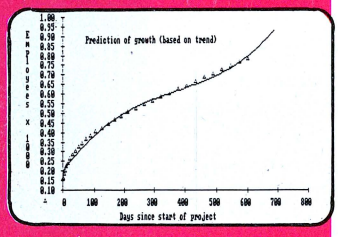

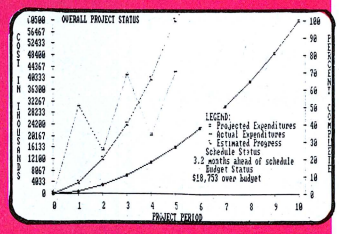

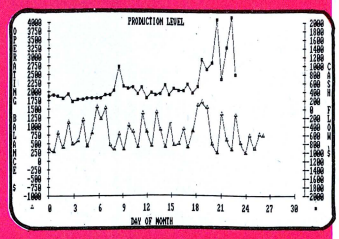

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You may also find the cross-referenced list useful for program optimization. If a program you've written doesn't run as fast as you'd like it to, you can use the cross referencer to find where your longest and most often used variable names are. Shortening these variable names will give you some speed improvement.

The program listed here produces a cross reference of all variables and Basic commands; at your option it also cross references all literals and line numbers. Cross referencing literals and line numbers takes additional time, so you may or may not want them included.

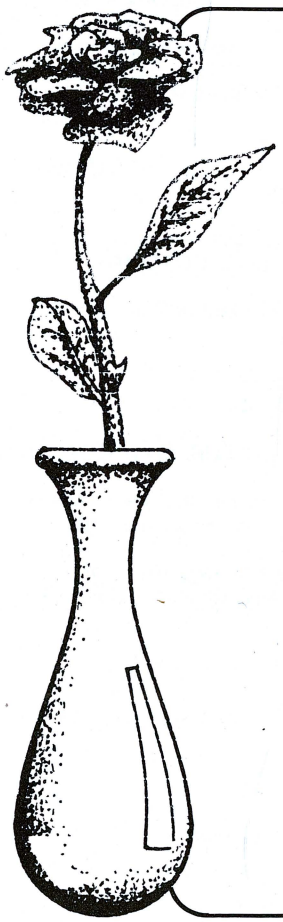
During execution this program creates a work file on drive A. It's therefore best, although not essential, to keep the input file and the work file on separate drives. For example, you might want to put the cross referencer in drive A and the program to be cross referenced in drive B.

To maximize the amount of storage available to the cross reference program, run it in the following manner:

```
BASIC /F:2/C:0
LOAD "XREF
RUN
```

A final note: the program, as listed here, will not work if your input program has line numbers higher than 32767.

```
100  REM ************************************
110  REM *     IBM Microsoft Basic Program    *
120  REM *       Cross Referencer — XREF      *
130  REM *          Nov 22, 1982   4:01       *
140  REM ************************************
150   DEFINT A-Z
160   KEY OFF: FOR I=1 TO 10:
      KEY I"": NEXT                  'Turn off function keys
170  '***---dimension arrays---***
180   TOT.V=9: MAX.V=TOT.V
190   DIM F$(9), VAR.REF(600,9)
200   DIM VAR.NAMES$(600), V.FILED(600), VAR.PTR(600)
210   DIM VARS.IN.ST$(30), JJ.PTR(36)
220   NUM.SKIP.WORDS=16: DIM SKIP.WORDS$(16)
230   GOSUB 1800                     'Initialization
240   GOSUB 2000                     'Instructions
250   GOSUB 2230                     'Open input file
260   OPEN "xref.wrk" AS #2 LEN=42   'Open work file
270  '***---field statements for work file---***
280   FIELD #2,2 AS IREC$, 20 AS F.N$
290   FIELD #2,22 AS D1$,2 AS F$(0),2 AS F$(1),2 AS F$(2),2 AS F$(3),2
      AS F$(4)
300   FIELD #2,32 AS D1$,2 AS F$(5),2 AS F$(6),2 AS F$(7),2 AS F$(8),2
      AS F$(9)
310   FIELD #2,22 AS D1$, 2 AS F0$, 2 AS F1$, 2 AS F2$, 2 AS F3$, 2 AS
      F4$
320   FIELD #2,32 AS D1$, 2 AS F5$, 2 AS F6$, 2 AS F7$, 2 AS F8$, 2 AS
      F9$
330   GOSUB 2090                     'Get flag settings
340   IN.TIME$=TIME$                 'Save start time
350   GOTO 430                       'Already have first record
360  '
370  ' ************************
380  ' *       Main Loop      *
390  ' ************************
400  '
410   IF EOF(1) GOTO 1550            'If end of input — go print
420   LINE INPUT #1,ST$              'Read Basic statement into ST$
430   VARS.IN.ST=0                   'Set variables found in ST$ = 0
440   FLAG.GO=FALSE                  'Set flag — not processing GOTO
450                                  'or GOSUB or RETURN
460   IX=INSTR(ST$," ")              'Find first space in statement
470   LINE.NUM=VAL(LEFT$
      (ST$,IX-1))                    'Set line number
480   PRINT LINE.NUM;          '<-- DISPLAY IT ON SCREEN
490   IS=IX+1                        'Set IS to first char past space
500   LINE.LEN=LEN(ST$)              'LINE.LEN = length of statement
510
```

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```
520  ' ***************************************
530  ' *          Loop within statement      *
540  ' *       looking for a character (A-Z)  *
550  ' *          or<" >     or<' >          *
560  ' *      Found: then I=position in ST$    *
570  ' ***************************************
580  '
590  FOR I=IS TO LINE.LEN
600   IF VAR$="REM" THEN LSET
      VAR$=" ": GOTO 410          'If REM — skip rest
610   LSET I$=MID$(ST$,I)        'Set I$ to char from statement
620   IF (I$>="A" AND I$<="Z")
      GOTO 780                    'If between A&Z then go
630   IF I$><D.Q$ GOTO 690        'Check for a literal ("xx")
640    J=INSTR(I+1,ST$,D.Q$)      'Get end of literal
650    IF J=0 THEN J=LINE.LEN
660    VAR$=MID$(ST$,I,J-I+1): J=J+1  'Set VAR$ to literal
670   KEEP=XREF.LITERALS          'Do we XREF literals?
680    GOTO 880
690   IF I$="'" GOTO 410          'Found comment — skip rest
700  NEXT
710 GOTO 410          'We fell thru loop thus done with this statement
720  '
730  '   *********************************
740  '   *        Loop within statement    *
750  '   *     Looking for end of variable *
760  '   *********************************
770  '
780  FOR J=I+1 TO LINE.LEN
790   LSET I$=MID$(ST$,J)         'Set I$ to char from
                                  statement
800   IF (I$>="A" AND I$<="Z") OR (I$>="0" AND I$<="9")
      GOTO 840
810   IF INSTR(SPECIAL.CHARS$,I$)>0
      GOTO 830                    'Special chars okay
820   GOTO 850                    'Var$ done
830   IF I$="(" THEN J=J+1: GOTO 850  'Var$ done
840  NEXT J
```

♥♥♥♥♥♥♥♥♥

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```
850  VAR$=MID$(ST$,I,J-1-I+1)          'Set VAR$ to variable
860  FLAG.GO=(VAR$="GOSUB" OR VAR$="GOTO" OR
     VAR$="RETURN" OR VAR$="RESUME")
870  GOSUB 1460                        'Check if we want to XREF
                                       this
880  IF NOT KEEP GOTO 1170
890  '***---Already found this VAR$ in this statement?---***
900  '***---if so then skip it---***
910  FOR I=1 TO VARS.IN.ST
920   IF VAR$=VARS.IN.ST$(I) GOTO
      1170                           'Already used so skip
930  NEXT
940  VARS.IN.ST=VARS.IN.ST+1:
     VARS.IN.ST$(VARS.IN.ST)=VAR$    'First time
950  '***---Find first variable greater or equal to VAR$---***
960   IF VAR$>="A" THEN VAR.SUB=55:
      GOTO 990                       'Set starting point for
970   IF VAR$>="1" THEN
      VAR.SUB=48: GOTO 990           '  search thru chain
980   IV=0: OLD.PTR=0: NEW.PTR=VAR.PTR(0): GOTO 1030
990    IV=ASC(VAR$)-VAR.SUB
1000   OLD.PTR=JJ.PTR(IV-1)
1010   NEW.PTR=VAR.PTR(OLD.PTR)
1020  '***---Search thru chain of variables---***
1030  FOR I=1 TO VARS
1040   IF VAR.NAMES$(NEW.PTR)>=
       VAR$ GOTO 1100                 'Found
1050   OLD.PTR=NEW.PTR: NEW.PTR=VAR.PTR(NEW.PTR)
1060   IF VAR.NAMES$(NEW.PTR)=""
       GOTO 1100                      'End of list
1070  NEXT
1080 '***---Not found so add to end of list---***
1090  NEW.PTR=0: GOTO 1120
1100  IF VAR.NAMES$(NEW.PTR)=VAR$ THEN I=NEW.PTR:
      GOTO 1140
1110 '***VAR$ not found - create entry, set ptr
1120  VARS=VARS+1: I=VARS: VAR.PTR(OLD.PTR)=I:
      VAR.PTR(I)=NEW.PTR: VAR.NAMES$(I)=VAR$
1130  IF VAR$ > VAR.NAMES$(JJ.PTR(IV)) THEN JJ.PTR(IV)=I
1140  IF VAR.REF(I,0)=MAX.V THEN GOSUB 1350
1150  ENTRY=VAR.REF(I,0)+1
1160  VAR.REF(I,ENTRY)=LINE.NUM: VAR.REF(I,0)=ENTRY
1170 IS=J
1180 IF FLAG.GO GOTO 1210            'Am I working on a
                                      GOTO, GOSUB or
                                      RETURN ?
1190 GOTO 590
1200 '***Get statement numbers
1210  IF IS>=LINE.LEN GOTO 590
1220  FOR I=IS TO LINE.LEN
1230   LSET I$=MID$(ST$,I)
1240   IF I$>="0" AND I$<="9" GOTO 1280
1250   IF I$><"," AND I$><" " THEN IS=I: GOTO 590
1260  NEXT
1270  IS=I: GOTO 590                 'End of line
1280  FOR J=I+1 TO LINE.LEN
1290   LSET I$=MID$(ST$,J)
1300   IF I$<"0" OR I$>"9" GOTO 1320
1310  NEXT
1320  VAR$=MID$(ST$,I,J-I) ♥♥♥♥
1330 IF XREF.LINENUMS THEN GOTO 970 ELSE IS=J: GOTO 1210
1340 '*** Write filled group, set up next
1350  V.FILED(I)=TRUE                'Say that we've written
                                      some on work file
1360 '---Entry point 2
1370  '***---Write out array of line numbers to work file---***
1380  LSET IREC$=MKI$(I): LSET F.N$=VAR.NAMES$(I)
1390  FOR I2 =0 TO MAX.V
1400   LSET F$(I2)=MKI$(VAR.REF(I,I2))
1410  NEXT
1420 REC=REC+1: PUT #2,REC
1430 VAR.REF(I,0)=0                  'Reset pointer to first in
                                      array
1440 RETURN
1450 '***---Search thru reserved words list---***
1460  FOR I=1 TO NUM.SKIP.WORDS
1470   IF SKIP.WORDS$(I)>=VAR$ GOTO 1500
1480  NEXT
1490  KEEP=TRUE: RETURN
1500  KEEP=NOT(VAR$=SKIP.WORDS$(I))
```

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```
1510 RETURN
1520 ' ********************************
1530 ' *        Final Printout of XREF      *
1540 ' ********************************
1550  OUT.TIME$=TIME$
1560  CLS: BEEP: PRINT "<P>rint  <E>nd"
1570  PR$=INKEY$: IF PR$="" GOTO 1570
1580  IF (PR$="E" OR PR$="e") GOTO 1850
1590  LPRINT CHR$(15)                    'Set for condensed print
1600  WIDTH "LPT1:",132
1610  LPRINT "  TIME IN = ";IN.TIME$
1620  LPRINT "  TIME OUT = ";OUT.TIME$
1630  I.PTR=VAR.PTR(0)
1640  FOR JI=1 TO VARS
1650   SPS=16-LEN(VAR.NAMES$(I.PTR))
1660   LPRINT "  ";VAR.NAMES$(I.PTR);SPC(SPS);
1670   IF NOT V.FILED(I.PTR)
       GOTO 1760                    'More on work disk ?
1680   FOR IR=1 TO REC
1690    GET #2, IR
1700    IREC=CVI(IREC$)
1710    IF IREC><I.PTR GOTO 1750
1720    LPRINT " ----";
1730    LPRINT "  ";CVI(F1$);CVI(F2$);CVI(F3$);CVI(F4$);CVI(F5$);
1740    LPRINT    CVI(F6$);CVI(F7$);CVI(F8$);CVI(F9$);
1750   NEXT IR
1760   LPRINT " ----";
1770   FOR I2=1 TO VAR.REF(I.PTR,0)
1780    LPRINT VAR.REF(I.PTR,I2);
1790   NEXT I2
1800   LPRINT
1810   I.PTR=VAR.PTR(I.PTR)
1820  NEXT JI
1830 GOTO 1560
1840 '*** END
1850  CLOSE ♥♥♥♥♥♥♥♥♥
1860 END
1870 '*** Init ***
1880  TRUE=-1: FALSE=0
1890  I$=SPACE$(1)                  'Set I$ to be 1 byte long
1900  D.Q$=CHR$(34)                 'Dbl quote
1910  SPECIAL.CHARS$="($!%#."       'Chars allowed in variable names
1920 '***---Basic commands that will not be XREF---***
1930  FOR I=1 TO NUM.SKIP.WORDS
1940   READ SKIP.WORDS$(I)
1950   DATA "AND", "AS", "DATA", "ELSE", "FOR", "GOSUB",
       "GOTO", "IF",
1960   DATA "LOCATE", "NEXT", "NOT", "OR", "PRINT",
       "RETURN", "THEN", "TO"
1970  NEXT
1980 RETURN
1990 '*** Instructions ***                    ♥♥♥♥♥♥♥♥♥
2000  CLS
2010  COLOR 0,7: LOCATE 2,12: PRINT " BASIC XREF PROGRAM ":
      COLOR 7,0
2020  PRINT: PRINT " Input -a BASIC program in ASCII format"
2030         PRINT " Output-a XREF listing (screen or print)"
2040  PRINT: PRINT "XREF creates work file on drive A"
2050         PRINT " thus - recommend data disk in drive B"
2060  PRINT
2070 RETURN
2080 '*** Set flags ***
2090  PRINT " Do you want to XREF literals (Y/N) ? ";
2100  GOSUB 2170                    'Get answer
2110  XREF.LITERALS=(CK$="Y" OR
      CK$="y")                      'Set XREF.LITERALS
2120  PRINT " Do you want to XREF referenced lines (Y/N) ? ";
2130  GOSUB 2170                    'Get answer
2140  XREF.LINENUMS=(CK$="Y" OR
      CK$="y")                      'Set XREF.LINENUMS
2150 RETURN
2160 '*** Get Y/N ***
2170  BEEP
2180  CK$=INKEY$: IF CK$="" GOTO
      2180                          'Wait for a key
2190  CK$=CHR$(ASC(CK$) AND &HDF)   'Make capital
2200  IF CK$>< "N" AND CK$>< "Y"
      GOTO 2170                     'Is it a Y or N ?
2210  PRINT CK$
2220 RETURN
2230 '  ******************************
2240 '  *       ---open input file---      *
2250 '  ******************************
2260  LOCATE 10,1: PRINT SPC(39)
2270  LOCATE 10,1: INPUT " Enter
      program name: ", PROGRAM$     'Get input file name
2280  ON ERROR GOTO 2380
2290  OPEN PROGRAM$ FOR INPUT
      AS #1                         'Open input file
2300  ON ERROR GOTO 0
2310  '*---Test for ASCII file---
2320  IF EOF(1) THEN MSG=1: GOSUB
      2420                          'No data
2330  LINE INPUT #1,ST$             'Read first statement
2340  FOR I=1 TO LEN(ST$)
2350   IF ASC(MID$(ST$,I,1))<17 ORASC(MID$(ST$,I,1))>126 THEN
       MSG=2: GOSUB 2420
2360  NEXT
2370 RETURN ♥♥♥♥
2380 '***---Open error---***
2390  IF ERR=53 THEN MSG=3: GOTO 2420
2400  IF ERR=52 THEN MSG=4: GOTO 2420
2410 ON ERROR GOTO 0                'Trap other errors
2420 '***---Errors---***
2430  BEEP: LOCATE 15,15: COLOR 0,7
2440  IF MSG=1 THEN PRINT " FILE EMPTY "
2450  IF MSG=2 THEN PRINT " FILE NOT ASCII "
2460  IF MSG=3 THEN PRINT " FILE NOT FOUND "
2470  IF MSG=4 THEN PRINT " BAD FILE NAME "
2480  CLOSE: COLOR 7,0
2490  FOR I=1 TO 3000: NEXT I: LOCATE 15,15: PRINT SPC(39)
2500  IF MSG=3 OR MSG=4 THEN RESUME 2230 ELSE GOTO 2230
```


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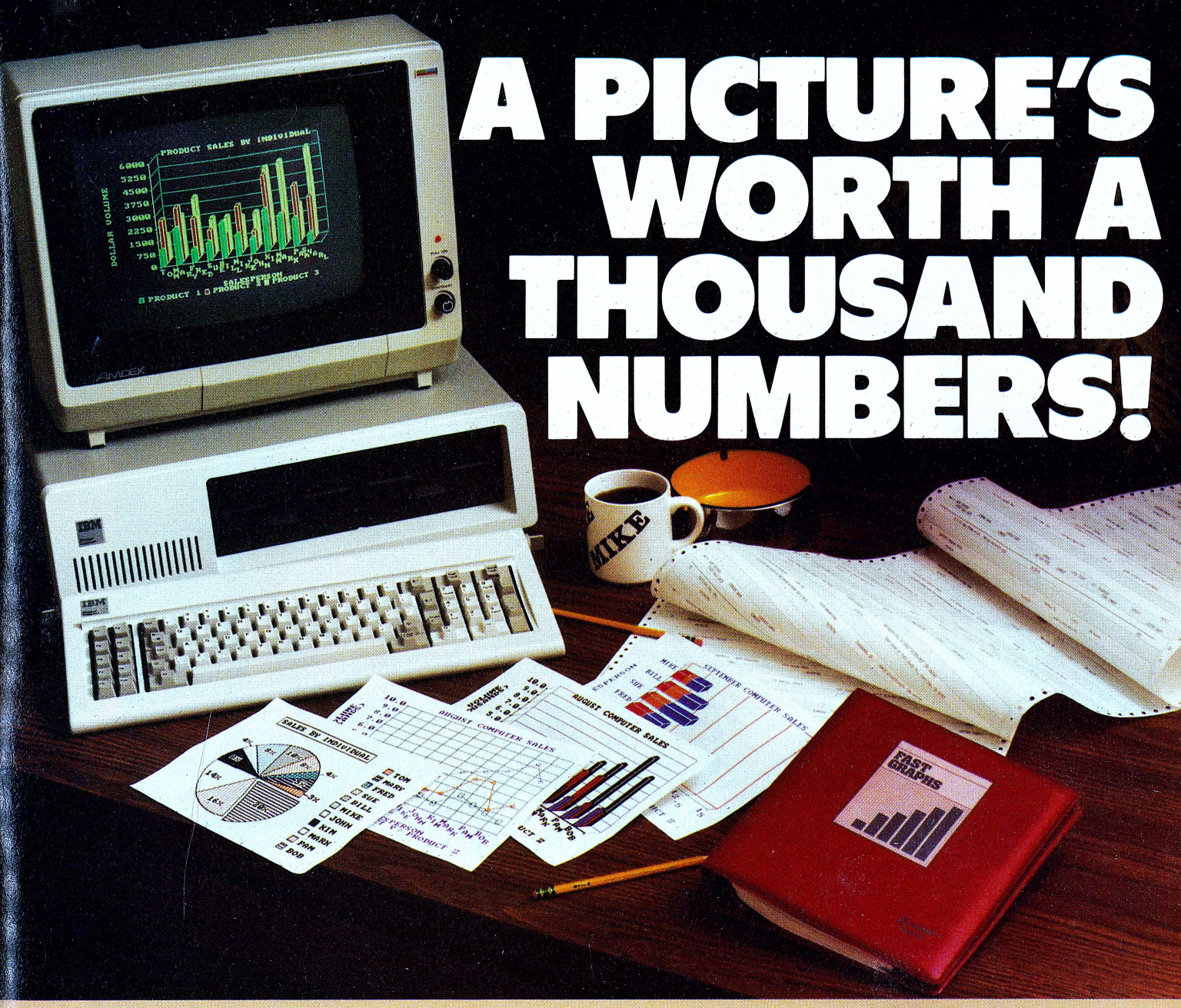
Joe Juhasz is associated with PCsoftware of San Diego, CA. He has written games, a graphics package, educational software, and a database manager—all for the IBM Personal Computer. ▲



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BRUCE ARTWICK: CLEA

by David Hunter

A week before he put the finishing touches on Microsoft's *Flight Simulator*, Bruce Artwick almost lost the whole thing in a blaze of destruction. The office building where he works was evacuated because of a bomb threat.

"It was against the IRS, which is one floor above me," says the tall, quiet, Illinois-born Artwick. "I unplugged my Winchester disk drive and ran out the front door with it under my arm."

Such incidents are not unheard of in Champaign, Illinois, but they certainly aren't commonplace. Champaign's big claim to fame is the University of Illinois. That makes it a college town as well as a farm community, which would account for occasional rowdiness. But bomb threats?

Luckily the threat was a fake and no bomb went off. ("The perfect placement for it would have been my ceiling.") Artwick finished his opus and IBM pc owners are now being treated to one of the finest programs available anywhere for a microcomputer.

Mr. Deeds Comes to Town. That it was only possible in the sixteen-bit world is the real story; but the designer of Microsoft's *Flight Simulator* is a fascinating character, one who has experienced much and yet remained true to his conviction that fame and fortune are secondary to the goal of developing superior technology. A software publisher and author, Artwick is something of an enigma, not the stereotypical programmer, not a playboy, not a laid-back software kingpin.

Gary Cooper, that's it. Tall, but unimposing; radiating inner strength, but not patronizing. Quiet, but active. Approaching thirty years of age, Artwick is part youth, part intellectual, part software engineer, part musician, and part daredevil.

"I've owned a total of fifteen motorcycles," Artwick says. "I sell them, I don't crash them."

Whether it's motorcycles, cars, skiing, volleyball, or assembly language, Artwick likes speed. He likes hard disk drives, BMWs, tearing down the Angeles Crest Highway on a Suzuki at a dangerous clip, and zooming through undergraduate and graduate school in four years.

The president of SubLogic Communications Corporation, Artwick is a licensed pilot; he flies the company plane, a Cessna 150, when the need arises or the mood strikes. He's also liable to tear off on his motorcycle

RED FOR RUNWAY 8088

through the nearest cornfield.

Owners of Apples, TRS-80s or S-100 computers will recognize Artwick and SubLogic as an unusually cerebral publisher of graphics programs and of the biggest selling flight simulator in the world. Both the TRS-80 and the Apple *Flight Simulators* were incredibly popular; Artwick and his partner at SubLogic, Stu Moment, believe there are more copies of Artwick's program sold than any other flight simulator of any kind in the world.

The good news for IBM Personal Computer owners is that Microsoft's *Flight Simulator* is a great deal better than the eight-bit versions published through SubLogic. Artwick already made several improvements to the 13K TRS-80 version with the bigger capacity of the Apple (three, count em, three more K in those early Apple days). Comparing the Apple version to the IBM pc version is akin to comparing Valentino's *The Sheik* to *Lawrence of Arabia.*

There *is* no comparison.

How Realistic Is It? Sure, you've read the ads. If it "got any more realistic, you'd need a license." This kind of claim is not characteristic of Artwick, but it is of Microsoft, who is distributing, packaging, and promoting *Flight Simulator.* Nevertheless, the boast is not without basis in reality.

Microsoft approached Artwick in late 1981 to do a flight simulator. Artwick recalls those days:

"Microsoft Consumer Products had a few good games for the IBM Personal Computer, but they wanted more than just *Olympic Decathlon* and *Adventure,*" he explains. "They wanted to demonstrate the difference between eight-bit and sixteen-bit technology."

Actually IBM approached Artwick before Microsoft did; they were looking for a nifty program to show off the color graphics potential of the pc.

"I went down to Boca Raton and talked with those folks. They had a good attitude and an outgoing development team, but we couldn't strike a deal that made everyone happy."

Once he made the choice to collaborate with Microsoft, Artwick approached the task of creating a second generation flight simulator with enthusiasm and gusto.

"Microsoft wanted a strict conversion of The TRS-80 *Flight Simulator* into the sixteen-bit format at first, but I told Alan Boyd [manager of product acquisition] we could do much more with the pc's 8088 processor.

"We started fairly modestly, and then began adding things—and adding more things. Once I was reasonably familiar with the Personal Computer's capabilities, the project really took off."

"We" was Artwick, Alan Boyd, and Vern Rayburn, former president of Microsoft's consumer products division, who recently left Microsoft for Lotus Development. In the future they may come up with a name for the kind of collaboration that produced the Microsoft *Flight Simulator.* It was more than an engineer just taking friendly advice and forging ahead alone. It was less than a group of screenwriters beating each others' work into Frankenstein's monster.

"Microsoft was very helpful in providing development tools. The whole thing ran smoothly as soon as I had a good assembler and linker. *PMATE* is a good editor, and the pixel editors on the pc are faster than on a Z-80-based system.

"Generally, you can't just go out and buy good graphics design tools, like pixel editors," says Artwick.

Artwick was like the chief architect of a team building a monumental structure. The project took close to a year from inception to delivery. Artwick and Microsoft were patient; they knew they had a winner and didn't want to cut a lot of corners just to get it on the market at any particular time. Still, the Christmas '82 season was highly desirable. Artwick delivered, but not without sacrificing a few things.

"There were weeks when nothing was done, but the last three months I worked sixteen to eighteen hours a day.

"There are still little additions I can make to the program. I actually ran out of time, as opposed to space," Artwick explains. "The shading of buildings and mountains and more details to the landscape are improvements you'll see in the update.

"There are also a couple of bugs that never showed up in all the beta testing. The kind that are easy to fix, but almost impossible to find."

By the time you read this, Microsoft should have Artwick's updated version in the stores. Tentative plans call for a still more improved version to appear later this year. ♥

100K and a Personal Computer. Artwick can be forgiven for the few minor imperfections. Creating the Microsoft *Flight Simulator* was not a trivial task. "The uncompiled source code is about 800K. The listing is three and a half inches thick," says Artwick with all due modesty. "The final compiled version, including databases, is a total of 100K. Loaded into the Personal Computer, it takes up a full 64K."

Twenty real airports, a World War I dogfight simulation, full instrumentation, night flight, easy mode, reality mode—the list of *Flight Simulator*'s wonders is long. Most impressive of all is the powerful illusion of flying an actual plane.

"Stu and I spent a lot of time flying the company plane, seeing if my mathematical

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calculations led to the same results in real flight. Most of the time I was accurate enough, but the simulation is not one hundred percent like the real thing."

For instance: "You should be able to perform a complete loop. The testers at Microsoft have tried, but no one has done it yet. It should be easier."

Learning to fly is not something you do in an afternoon. Artwick knows all the trials and tribulations from his own days as a student pilot. At first, he and planes did not get along, but through the help and guidance of Stu Moment, Artwick eventually grew to love the fragile and complicated machines.

Artwick met Moment in the early seventies when they were both attending the University of Illinois. They roomed together with a dozen other spirited students in a big old house dubbed Gamma Ray Zappa. The house was evenly split up among AV (aviation) jocks, parachuters, and electrical engineers.

A Pretty Crazy Bunch of Guys. Moment was one of the AV jocks. Artwick was one of the electrical engineers. "We agreed that Stu would teach me to fly if I taught him about digital electronics," he remembers.

When he wasn't entrenched at the university's digital computer labs, Artwick was doing the things only college students and devil-may-care parachuters can think up. He enjoyed the vibrant atmosphere and the chance to learn about flying.

An electrical tinkerer for years, Artwick surprised no one when he started to build his own computer. On his homemade BACS 1000 (Bruce Artwick Computer System), Artwick "did some 3-D stuff and even a real-time runway. I just had to have my own real-time 3-D graphics."

He completed the bachelor's and master's degrees in electrical engineering in four years.

Artwick says that when he started college, there was a fifty-fifty chance that he would study music instead of engineering. The excellent curriculum at the University of Illinois helped seal his fate, and once he had committed himself to engineering Artwick pursued with ferocious passion his love of computers. When he finished school, he landed a job at Hughes Aircraft in Culver City, California.

Through most of his college career, Artwick was hardware oriented and was particularly interested in computer design. Then his thesis project called for creating a real-time simulator on the PDP-11. As it turned out, that thesis project had quite an influence on Artwick's career in microcomputer software.

"Pinball Wizard, There Has To Be a Trick." Until recently, Artwick did most of his programming on a S-100, Z-80-based sys-

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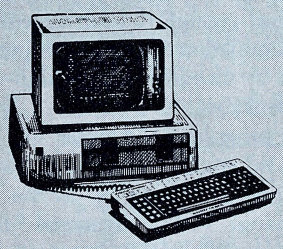

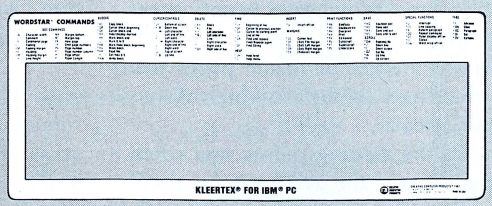

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tem and then translated it to other machines. Now that he's discovered the pc, those days are coming to a close. Artwick now plans to use the IBM Personal Computer as the central development system for most of his programming.

For instance: "I translated *A2-PB1: Night Mission Pinball* to the Atari through the pc—from Apple to IBM to Atari. As a byproduct, I ended up with an IBM version of the pinball game."

One complaint that Artwick does have against the IBM Personal Computer is its lack of a hardware reset button. "I don't like to spin down my Winchester twenty times a day," he says.

Microsoft's *Flight Simulator* posed many unique challenges, some of which Artwick made even greater.

"One of the turning points was when it came time to make the databases for the flying world in the program," he explains. "The usual approach is to make a fake world. But I thought, 'Why not make it the real world?' I developed a coordinate system that includes most of the United States, part of Canada, and all the way down to the Caribbean."

It's true! You could fly from Chicago to Seattle; it's all there in the program. Unfortunately, you'd need to refuel along the way ♥

and the program only has airports in four major areas—New York, Chicago, Seattle, and Los Angeles.

The 3-D animated graphics of *Flight Simulator* were another feature on which Artwick worked long and hard. Ranging from five to sixteen frames of animation per second, *Flight Simulator*'s animation has been justly compared to a movie.

"The technology is called incremental fill and allows for solid graphics instead of line graphics," Artwick explains. "The shading in of areas fast enough to keep up with the rest of the simulation was a major problem that I solved by using these new high-speed graphics techniques.

"In the program solid areas are filled with color. When the scene shifts on the screen, you only have to fill in the small areas that change. With incremental fill, you don't have to refill the whole screen every time the scene shifts."

Sixteen O'Clock High. When the plane is above the clouds and there is very little on screen, the animation goes at a blazing sixteen frames per second. When there are more visual elements, such as buildings or an airport, the animation is slower but the effect is still spectacular. Artwick makes it look easy.

Hail the wonders of assembly language and the 8088 processor!

"In order to create the 3-D graphics lines, I used an Apple graphics tablet as a map maker," explains Artwick about another aspect of the *Flight Simulator*'s creation. "To simulate an approach or taxi slant, I'd trace the map on the tablet and then use the interpreter to put it into the proper graphics language."

All through his labors, Artwick was looking for ways to improve the simulation.

"I wanted it to be more aerobatic than any of the previous simulators, particularly in the World War I dogfight game."

A nifty feature is the adjustable parameters that allow a user to choose the time and conditions of flying. "The plane itself is not very adjustable, because inside the simulation there are many mathematical formulas that can't vary," Artwick explains.

Other details were included more for fun than anything else. "I included the Hughes airport in Culver City because of all my friends who work there. I even tried to make the color of the buildings the same dull Hughes green."

Artwick also included the University of Illinois Willard Airport, the one with which he's most familiar. That it's a good forty-minute flight from Chicago shows how much he's willing to put in, given the chance.

Moby Manual. *Flight Simulator* has the biggest manual that Microsoft has ever produced for a game product. Complete with maps, references, and detailed diagrams of the flight instruments, *Flight Simulator*'s manual is almost a work of art in itself.

Artwick's *Flight Simulator* is so close to the real thing to a professional flight simulator, that you may be able to satisfy certain FAA rules for instrument currency and practiced instrument approaches. It's not good for accumulating flight hours toward a new rating, however; the reason is that the input device is the pc's keyboard. Real simulators come complete with foot pedals, a yoke for operating the elevators and ailerons, and other physical realities of a small plane.

Artwick and Microsoft are contemplating joystick control for *Flight Simulator*, but that would entail "writing software to time out the interweaving of the input device with the other functions."

In the meantime, Artwick and Moment are developing what they call a "universal simulator" for the Apple. Not just another joystick, this multiplexed, seven-channel contraption will give a more realistic aspect to *Flight Simulator*, possibly including foot pedals, a yoke, a separate throttle, and other features.

Naturally the universal simulator will be adaptable to other kinds of programs. Artwick believes it could add a whole new aspect to computer gaming. One exciting feature would be motion feedback, a software/hardware coordination allowing more precise control and more accurate response.

No plans are alive at the moment for making the Microsoft *Flight Simulator* compatible with the universal simulation controller, but the possibility is there.

The future looks good for simulations on the IBM Personal Computer, and the present isn't too shabby either. Artwick's *Flight Simulator* takes its place beside *1-2-3* as testimonial of what is possible with the 8088 processor.

The Amsterdam Connection. Artwick is currently working on a book about interactive computer graphics as well as on an ambitious computer-aided design project with associates in Amsterdam. The CAD project is very close to his heart, and Artwick considers it his most important and complex creation to date. It's not for the pc—unlucky us.

Between software engineering and running SubLogic, Artwick gets a chance every so often to fly in the company plane with his partner, Moment.

"We flew out of Kansas City one evening and it was beautiful. I decided to include night flight and dusk flight because it made such an impression on me."

Microsoft's *Flight Simulator* is a personal effort in some respects and a group project on the whole. It will not fail to make an impression. Wipe off your goggles, put in your earplugs, zip up that flyer's jacket, and get ready. The pc is taking off. ▲

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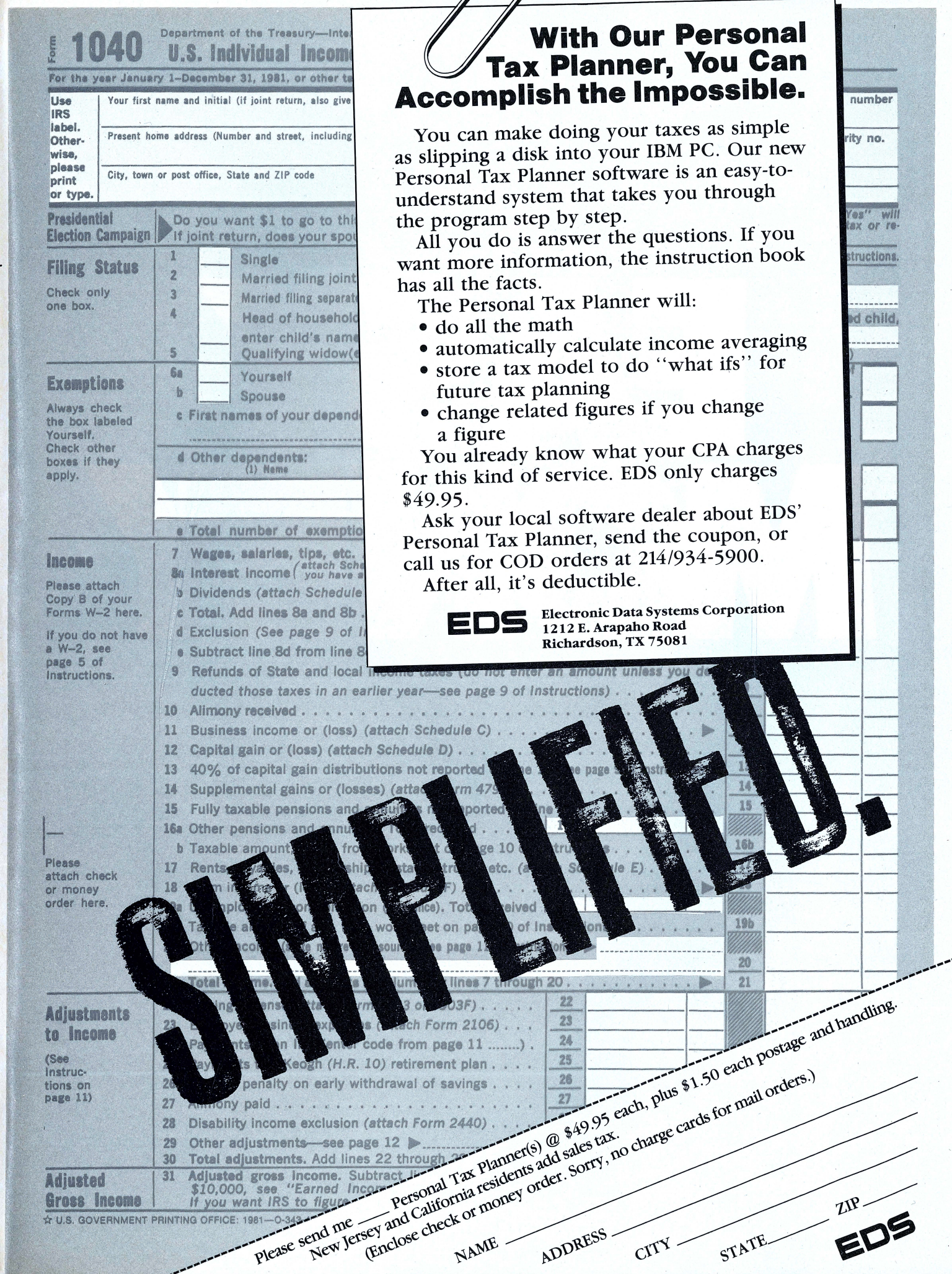
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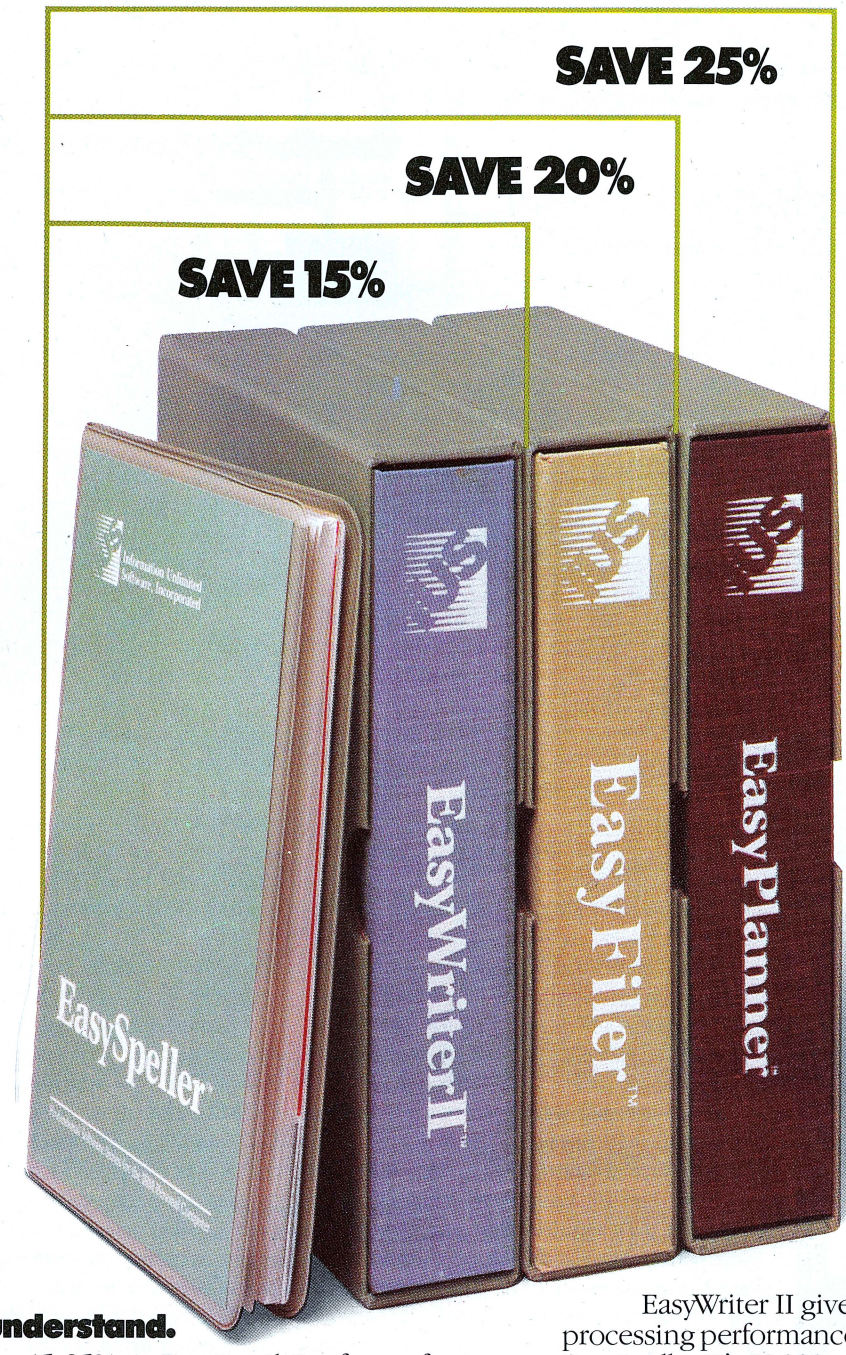

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BOARDS & BUSES

by Richard Kaapke

This month we spotlight two more memory expansion products for the pc: the AST Research MegaPlus memory card and the Tecmar All-in-One.

MegaPlus is a memory card that's expandable to 512K and comes with two asynchronous communication adapters (serial ports), a parallel printer adapter, and a date/time clock with battery backup. You also get a disk with AST's Superpak utility programs for printer spooling, setting of the time and date, and RAM disk emulation.

The MegaPlus is well laid out; it would have to be to get that much function on a single card. A connector for the primary communications adapter sticks out the back slot of your pc, and additional mounting brackets and cables are available to bring the other two ports (the parallel port and the second serial port) out other slots—or even out the same slot the MegaPlus occupies.

The MegaPlus has sockets for 256K. To expand to 512K you insert a small MegaPak card into pins on the MegaPlus; the additional 256K so mounted sits directly above the first 256K.

Memory size options for the MegaPlus are 64K, 128K, 192K, 256K, and 512K. The reason there aren't any options between 256K and 512K is that the MegaPak card comes with its 256K soldered in. The memory on the MegaPak can either be part of the system memory, or the last 192K may be put into the C0000-EFFFF address space—a suitable place for special software stacks and register storage.

The MegaPlus lets you adjust the settings of the connector on the back to be either COM1 or COM2; you can also set the connector to be in either the DTE or the DCE configuration. The second connector may also be set to either DTE or DCE mode, but, unlike the first, it's always set as COM2. The parallel printer adapter may be configured as LPT1, LPT2, or LPT3.

The Superpak utility software with the MegaPlus unfortunately leaves a little to be desired. The Superdrv program that lets you use part of your new memory as an electronic disk requires that you change the system switches inside the pc cabinet to reflect the total number of drives, electronic and otherwise. This may lead to some frustration and anguish when you want to add another electronic drive temporarily, *while you're running a program*. Another weakness of Superdrv is that fact that it doesn't allow easy reallocation of memory used as an electronic drive; you have to reboot the system in order to release that memory from disk-emulation duty.

The clock update and reading programs are well written. Astclock automatically loads the settings of the battery-powered clock into the computer's RAM (where date and time functions work normally); Setclock allows you both to read the settings from the battery-powered clock and to set the battery-powered clock (by means of the *date* and *time* commands).

The spooler program included with MegaPlus is more than just a print buffer that holds information on its way to the printer. Superspl can direct its output to any standard parallel or serial port, pause and resume printing, and even reprint a previously output page; this last facility is useful in the event of a paper outage or other printer error. The only thing one might possibly want in addition to what Superspl provides is a way to operate the spooling functions from within a program; it would be nice, for example, to be able to address Superspl with dot commands from *WordStar*.

The MegaPlus manual offers some welcome information in addition to the standard setup instructions; appendices list dynamic RAM chips that work in the MegaPlus, provide serial port cabling information, and tell how to change the default parallel printer address and the port assignments of the battery-powered clock.

The All-in-One board, by Tecmar, is a 64K-256K memory card with a battery-powered clock, an asynchronous communications adapter, and a parallel printer port. The asynch adapter is mounted on the end of the All-in-One, is addressable as COM1 or COM2, and may be configured to either DTE or DCE. The parallel port may be addressed as either LPT1 or LPT2; its cable has to pass out of the cabinet by way of an adjacent or other nearby slot, since serial port already occupies the opening directly behind the All-in-One board.

The board comes with spooler software and a program to set the date and time—but, unfortunately, no RAM disk emulator.

Tecmar's spooler program is a very simple printer buffer and doesn't come close to the sophistication of AST's Superspl program. If something happens to have printed wrong, via the Tecmar spooler, your only recourse is to start over; there's no facility to back up a page and try again.

The Tecmar and AST products, in summary, are similar to a point, but the AST card goes beyond the capability of the Tecmar product. Both cards, on review, worked as advertised, and the software for both ran without hitch. ▲

MegaPlus, *AST Research (2372 Morse Avenue, Irvine, CA 92714; 714-540-1333). $595-$1,095.*
All-in-One, *Tecmar (23600 Mercantile Road, Cleveland, OH 44122; 216-464-7410). $565-$975.*

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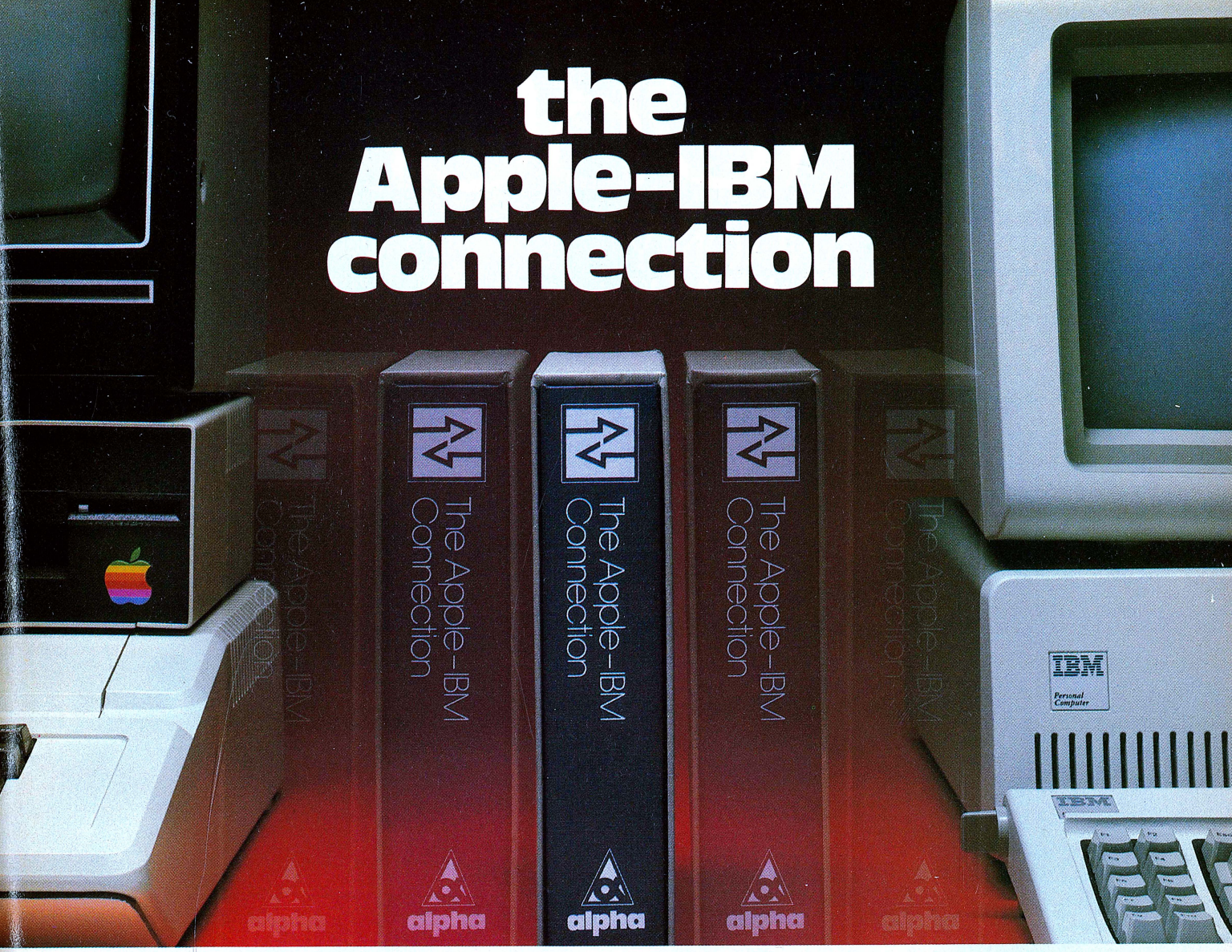

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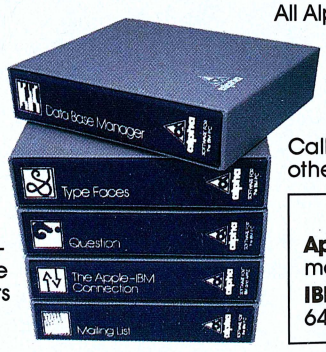

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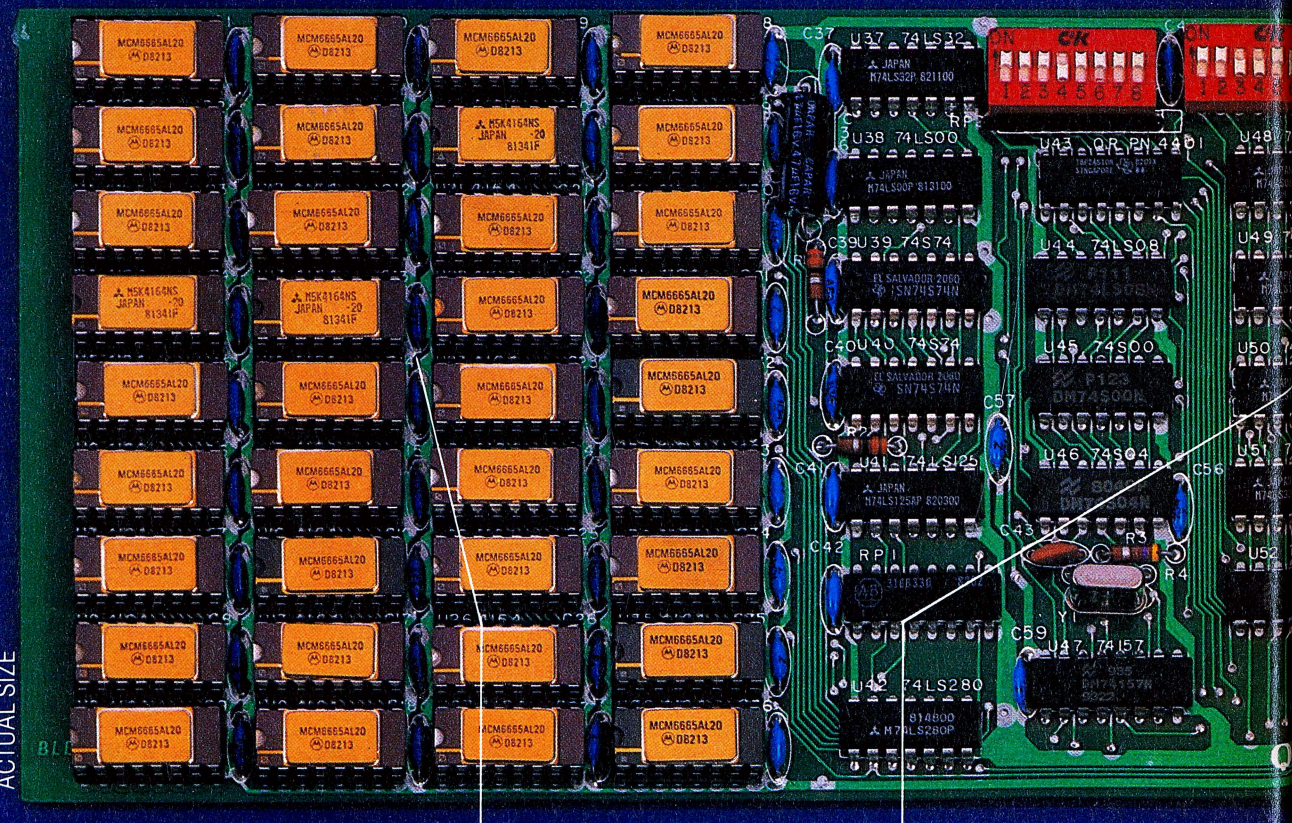

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QUESTIONS & ANSWERS

by Nancy Andrews

Q: I'm interested in programming a scrolling function and have been unable to locate enough information in the manuals to be able to do it. I'd like to do it from Basic, but I do have the Macro Assembler.

Howard Schneider ♥

A: The secret to scrolling is found in the DOS BIOS (IBM *Technical Reference Manual*, page A-44). One way to scroll is to write an assembly language subroutine and call it from your Basic program. Your call will need five parameters:

ULR	: row of upper left corner of scroll
ULC	: column of upper left corner of scroll
LRR	: row of lower right corner of scroll
LRC	: column of lower right corner of scroll
LENGTH	: length of scroll

A sample assembly language subroutine looks like this (this one is modeled on the *call* statement section in the Basic manual—pages C12 and following):

```
SUBRT PROC          FAR
      PUSH BP             ; SAVE BP
      PUSH AX             ;SAVE AX
      PUSH BX             ; SAVE BX
      PUSH CX             ; SAVE CX
      PUSH DX             ; SAVE DX
      PUSH SI             ; SAVE SI
      MOV BP, SP          ; SET BASE PARM LIST
      MOV SI, [BP]+16     ; GET ADDR PARM A
      MOV CH, [SI]        ; GET VALUE OF A
      MOV SI, [BP]+14     ; GET ADDR PARM B
      MOV CL, [SI]        ; GET VALUE OF B
      MOV SI, [BP]+12     ; GET ADDR PARM C
      MOV DH, [SI]        ; GET VALUE OF C
      MOV SI, [BP]+10     ; GET ADDR PARM D
      MOV DL, [SI]        ; GET VALUE OF D
      MOV SI, [BP]+8      ; GET ADDR PARM E
      MOV BH, [SI]        ; GET VALUE PARM E
      MOV SI, [BP]+6      ; GET ADDR PARM F
      MOV AL, [SI]        ; GET VALUE PARM F
      MOV AH, 6           ; PUT 6 IN AH TO SCROLL UP
                          ; 7 TO SCROLL DOWN
      DEC CH              ; DECREMENT C AND D REGISTERS
      DEC CL
      DEC DH
      DEC DL
      INT 10H             ; CALL VIDEO INTERRUPT
      POP BP              ; RESTORE BP
      POP AX              ; RESTORE AX
      POP BX              ; RESTORE BX
      POP CX              ; RESTORE CX
      POP DX              ; RESTORE DX
      POP SI              ; RESTORE SI
      RET 12              ; FAR RETURN TO BASIC
SUBRT ENDP
```

If you'd rather use Basic, poke the hex codes and addresses of the assembly subroutine into a fixed location in memory and call the subroutine. Here's a scroll program written in Basic that does this.

```
5 DEF SEG
6 SCROLL=&HB000
10 FOR ADDRESS=SCROLL TO SCROLL+&H40
12       READ CODE
13       POKE ADDRESS, CODE
15 NEXT ADDRESS
30 ULR%=1: ULC%=1
32 LRR%=10: LRC%=50
34 ATTR%=53
36 LENGTH%=6
40 CALL SCROLL (ULR%, ULC%, LRR%, LRC%, ATTR%,
   LENGTH%)
50 END
1000 DATA &h55
1010 DATA &h8b,&hec
1020 DATA &h50
1030 DATA &h53
1040 DATA &h51
1050 DATA &h52
1060 DATA &h56
1070 DATA &h8b,&hb6,&h10,&h00
1080 DATA &h8a,&h2c
1090 DATA &h8b,&hb6,&h0e,&h00
1100 DATA &h8a,&h0c
1110 DATA &h8b,&hb6,&h0c,&h00
1120 DATA &h8a,&h34
1130 DATA &h8b,&hb6,&h0a,&h00
1140 DATA &h8a,&h14
1150 DATA &h8b,&hb6,&h08,&h00
1160 DATA &h8a,&h3c
1170 DATA &h8b,&hb6,&h06,&h00
1180 DATA &h8a,&h04
1190 DATA &hfe,&hcd
1200 DATA &hfe,&hc9
1210 DATA &hfe,&hce
1220 DATA &hfe,&hca
1230 DATA &hb4,&h07
1240 DATA &hcd,&h10
1250 DATA &h5e
1260 DATA &h5a
1270 DATA &h59
1280 DATA &h5b
1290 DATA &h58
1300 DATA &h5d
1310 DATA &hca,&h0c,&h00
```

Of course, you can change any of the five parameters (lines 30-36) as well as the memory location (line 6). Also, this program scrolls down. To scroll up change the last value in line 1230 to &h06.

Q: Your October issue contained a letter from an irate Cobol user who was unable to run his business applications because of apparent bugs in IBM Cobol. I too have purchased the Cobol Compiler and would like to know what these bugs are.

Steve Smith

A: Mr. Wilcox's problem occurred when his files exceeded one disk. He claimed that one should be able to set a status flag that would indicate when the disk was full, then write a declarative section stipulating that when this flag appeared processing should stop, the file on the current disk should be closed, the operator should be instructed to insert another disk, and the file should be reopened on the second disk.

IBM maintains their Cobol 1.0 was only intended to handle files within a single disk. However, version 2.0, which has just been released, does handle files that span more than one disk.

IBM maintains their Cobol 1.0 was only intended to handle files within a single disk. However, version 2.0, which has just been released, does handle files that span more than one disk.

Here's some additional information about IBM Cobol's capabilities and limitations that you might find useful.

1. It conforms to the low intermediate level of the American National Standard and provides nine of the twelve modules. It includes all of level 1 and most of level 2.

2. Modules not included are the report writer and sort/merge. IBM Cobol gets around the sort/merge limitation by providing a very sophisticated indexed file system that makes it easy to sort records into various sequences based on key field.

3. Indexed files are subject to the following limitations: multiple key indexing is not supported; the record key must be alphanumeric; the key length maximum is sixty bytes; and duplicate keys are not permitted.

4. If you use segmentation to write larger programs, you may find that *display screen* and *accept screen* do not work in the segment. However, if you use *display* and *accept* prior to performing the segment, they will work.

5. Another alleged bug involves the order in which data is moved into a record field in the declarative section. If you initialize your first field to spaces and then attempt to read this record, you'll get a "Status Flag 23—no record found" message. The reader who reported this problem got around it by putting his field 2 initialization statement (which he initialized to zeros) *before* the field 1 statement; then the program ran successfully.

Version 2.0 is reported to have fixed this problem.

We've received several requests for more information about IBM's Dealer Response Hotline.

The Dealer Response Hotline is IBM's response to end-user problems or questions. Instead of talking to users directly, IBM will only talk to us through our dealers.

Here's how it works:

1. Take your problem or request for a patch to your dealer. It's best if you provide a brief statement of the problem in writing, because, if it's a new problem, the dealer must explain to to IBM for you.

2. Then, if your problem is not new, and a solution exists, and if your dealer does not have the solution, IBM will mail the patch to your dealer, who will see that you get it.

3. If there's no currently available solution and IBM recognizes your problem as a legitimate bug, they will work on a patch and send it to the dealer who requested it.

4. Eventually, copies of all patches should be sent to all dealers.

We tried the Dealer Response Hotline when we received the Pascal error question printed in January. It was awkward explaining the problem to IBM via the dealer because our dealer did not know Pascal or any other high-level language. However, IBM, after a five-week delay, finally did respond to our dealer with a patch. We applied the patch, ran the test program, and received the message, "Patch applied correctly." However, when we attempted to compile and run the program that originally produced the error, we got the message, "Compiler internal error—contact technical support." We then went back to our dealer who again called the Dealer Response Hotline. He was very persistent, and IBM guaranteed prompt attention to the problem. This was two weeks ago and to date we have heard nothing.

As you can see, this method may get results, but is extremely inefficient for both you and your dealer. You will have to wait a lot. And your dealer must be willing to take the time to follow through for you.

Both dealers and users object to this system, and IBM may finally be hearing this dissatisfaction. Currently, they're experimenting in several Product Centers with an 800-number hotline for customers. If this revolutionary concept is successful, we may some day have a direct link. Until then, good luck with the Dealer Response Hotline. ▲

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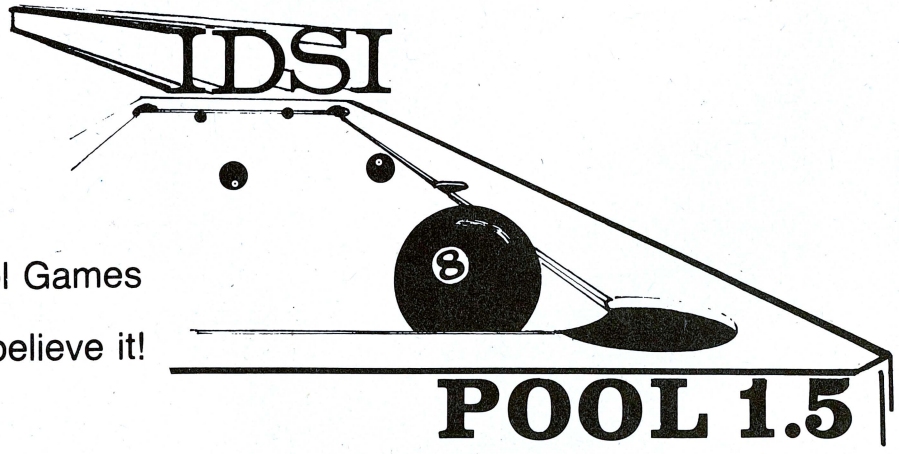

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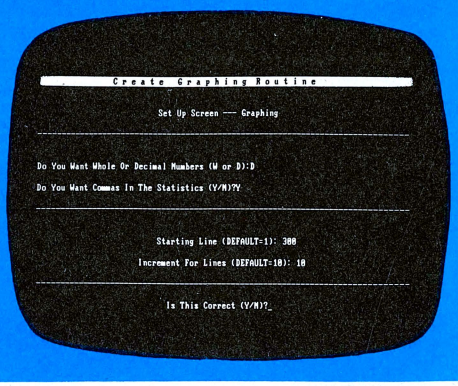
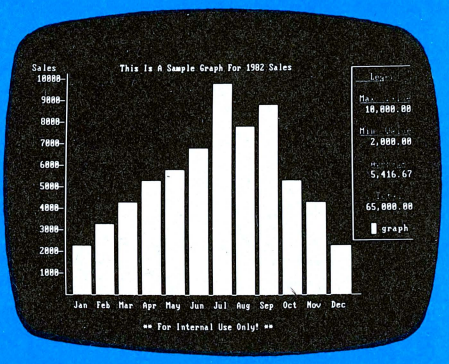


FINISH



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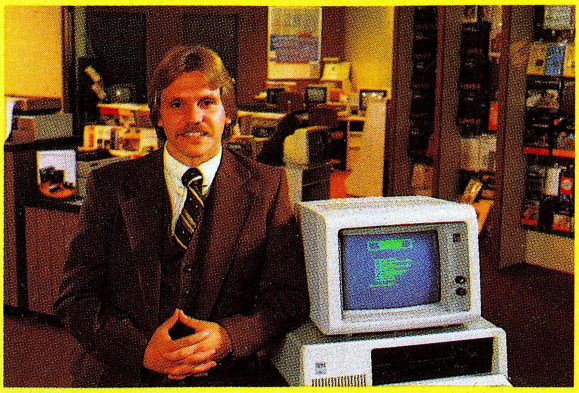

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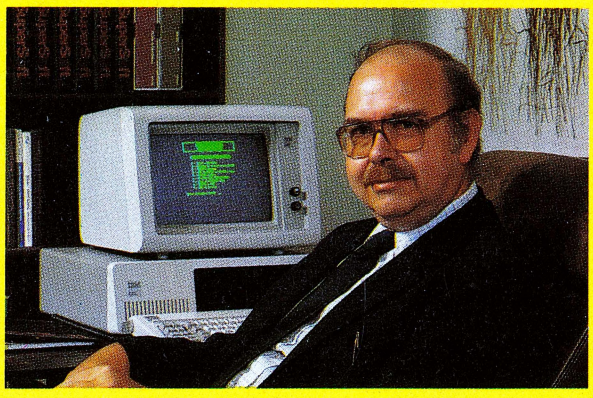
Ed Coudal, software reviewer and writer.



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softalk presents the bestsellers

The great god of commerce smiled on the IBM pc marketplace in December, leaving dealers and software publishers alike chuckling in their chips. But the results didn't exactly clarify the question of whether the pc is exclusively a business machine or whether there's a substantial fun-loving audience at home.

At VisiCorp and MicroPro, they think they know the answer—and they aren't doing *Pac-Man* emulations. One might assume likewise that Microsoft, makers of DOS and probably participators in the decision that color should be an expensive extra, would hold to that line of thought.

That's where one of the conflicting signals from the holiday season arises, however. Microsoft, in conjunction with Bruce Artwick, introduced the *Microsoft Flight Simulator* just in time for Christmas.

Artwick had already executed at least two versions of the program, one for the TRS-80 and one for the Apple, and both were big hits. But his pc version is akin to the prior versions in roughly the same relationship that you're a kin of Adam.

The pc version is a programming tour de force that was pushed through the system by Microsoft's Alan Boyd. Boyd's been bothered by the feeling that all he was seeing on the pc were warmed-over eight-bit programs. *Flight Simulator* is his statement that sixteen-bit is at least twice as good.

And the public seemed to agree. In its first month, Artwick's artistry zoomed to the number three position, behind *WordStar* and *VisiCalc*.

Added evidence that there's a frivolous side to the pc market was the arrival of *PC Man* in fifth place. The dot-eater came from nowhere with a lot less marketing clout than *Flight Simulator* and became the second biggest holiday hit.

Past polls have pointed to an untapped fun-loving segment of the pc market, with FriendlySoft and Infocom doing especially well.

But there's contradictory evidence as well. *WordStar* and *VisiCalc* were still head and shoulders above the pack, even at Christmas.

And why did the market ignore *Adventure in Syrenia, Ulysses and the Golden Fleece*, and *Crossfire*? These are three packages that had boffo runs in other venues. And *Microsoft Decathlon* and *Microsoft Adventure*, marketed by IBM, didn't seem to get relative sales boosts during the gift-giving season.

So the jury's still out on whether game-makers can expect to earn their keep in the pc market. What can they make of a market where *Macro Assembler* outsells a stellar product like *Temple of Apshai* at Christmastime?

On the other hand, no matter what Mom or Pop do with the pc during the day, it seems they're willing to let the kids have at it at night. High-quality educational packages entering the market have found favor with buyers.

Spinnaker struck gold with companion packages aimed at teenagers and preteens: *Snooper Troops I* and *II*.

Two packages aimed at the toddler crowd, Spinnaker's *Facemaker* and Early Game Company's *Early Games for Young Children*, also gained the attention of pc owners, though not enough to earn a spot on the Top Thirty.

For the third straight month, there was a significant increase in the number of titles available. But that didn't alter the outcome much: mostly there was just minor shuffling of positions among well entrenched programs.

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WordStar retained the top spot, but *VisiCalc* moved well within striking distance in second. *SuperCalc* dropped to fourth as *Flight Simulator* garnered third. *PC Man* nabbed fifth and old-timers *Home Accountant Plus* and *dBase II* tied for sixth.

Easy Writer II jumped four notches to eighth, *Zork I* vaulted into ninth, and *Microsoft Decathlon* dropped to tenth.

The never-ending saga of market positioning continued unabated in the areas of database software, word processors, and accounting packages.

It appears the market has ratified *dBase II* as the leading database, but *Total Information Management* has moved strongly into second with *VisiFile* dropping to third.

WordStar, of course, heads the word processing contingent, although *Easy Writer II* closed the margin considerably. And a renovated *Volkswriter* stormed into a contending position, dropping *Easy Writer 1.1* to fourth in the category.

Another reversal of fortunes occurred among accounting packages. Just when it seemed that the BPI package was gaining dominance over the Peachtree offering, Peachtree's *General Ledger* gained the upper hand in December.

The volatility of some of these programs may indicate a window of opportunity for publishers of quality business software. But that ignores the ambiguity of the December results:

What about games? ▲

IBM Personal Computer sales outlets representing approximately 4.7 percent of all sales of pc and pc-related products volunteered to participate in the poll.

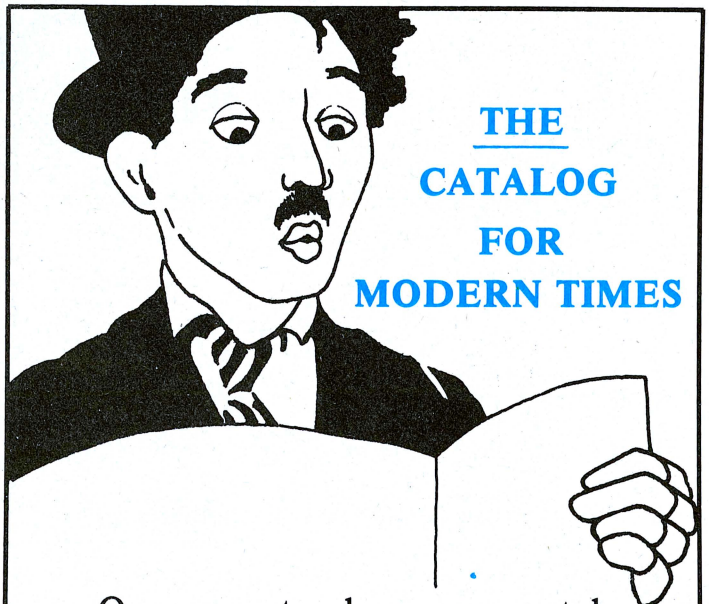
Respondents were contacted early in January to ascertain their sales for the month of December.

The only criterion for inclusion on the list was the number of units sold—such other criteria as quality of product, profitability to the computer store, and personal preference of the individual respondents were not considered.

Respondents in January represented every geographical area of the continental United States.

Results of the responses were tabulated using a formula that resulted in the index number to the left of the program name in the Top Thirty listing. The index number is an arbitrary measure of relative strength of the programs listed. Index numbers are correlative only for the month in which they are printed; readers cannot assume that an index rating of 50 in one month represents equivalent sales to an index number of 50 in another month.

Probability of statistical error is plus or minus 5.1 percent, which translates roughly into the theoretical possibility of a change of 5.47 points, plus or minus, in any index number.



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the top thirty

This Month	Last Month	Index	
1.	1.	130.98	**WordStar;** MicroPro
2.	2.	124.88	**VisiCalc,** Software Arts/Dan Bricklin and Robert Frankston; VisiCorp, IBM
3.	—	99.77	**Microsoft Flight Simulator,** Bruce Artwick; Microsoft
4.	3.	64.47	**SuperCalc;** Sorcim
5.	—	42.08	**PC Man;** Greg Kuperberg, Orion
6.	5.	38.68	**Home Accountant Plus,** Mike Farmer, Bob Schoenburg, Larry Grodin, and Steve Pollack; Continental Software
	7.	38.68	**dBase II,** Wayne Ratcliff; Ashton-Tate
8.	12.	34.61	**EasyWriter II,** Basic Software Group; Information Unlimited Software
9.	20.	29.18	**Zork I,** Infocom
10.	5.	27.15	**Microsoft Decathlon,** Microsoft/Tim Smith; IBM
11.	10.	26.47	**FriendlyWare PC Introductory Set,** Michael D. Yaw, James J. Davis, Frank Smith, Alan Vanchura, John Leatherwood, and Bruce W. Moore; FriendlySoft
12.	27.	22.40	**Zork II,** Infocom
13.	28.	21.72	**Total Information Management;** Innovative Software
14.	4.	19.00	**Asynchronous Communications Support 2.0;** IBM
	8.	19.00	**Crosstalk;** Microstuf
	18.	19.00	**General Ledger;** IBM (Peachtree Software)
17.	13.	16.97	**VisiFile,** Creative Computer Applications/Colin Jameson and Ben Herman; VisiCorp
18.	—	15.61	**Volkswriter,** Camilo Wilson; Lifetree
19.	15.	14.93	**MBA;** Context Management Systems
	16.	14.93	**General Accounting,** John Moss and Ken Debower; IBM (BPI)
	18.	14.93	**MailMerge;** MicroPro
	29.	14.93	**Deadline,** Infocom
23.	23.	12.89	**Microsoft Adventure,** Gordon Letwin (Will Crowther and Don Woods); IBM (Microsoft)
24.	21.	12.22	**IBM Pascal,** Microsoft; IBM
25.	10.	11.54	**Basic Compiler,** Microsoft; IBM
	14.	11.54	**VisiTrend/VisiPlot;** VisiCorp
	—	11.54	**Snooper Troops I,** Tom Snyder; Spinnaker Software
28.	8.	10.86	**Macro Assembler,** Microsoft; IBM
	—	10.86	**Snooper Troops II,** Tom Snyder; Spinnaker Software
30.	29.	8.82	**Temple of Apshai,** Jeff Johnson, John Freeman, and J.W. Connelly; Epyx/Automated Simulations
	—	8.82	**Typing Tutor,** Michael Sierchio (Dick Ainsworth and Al Baker); IBM (Microsoft)

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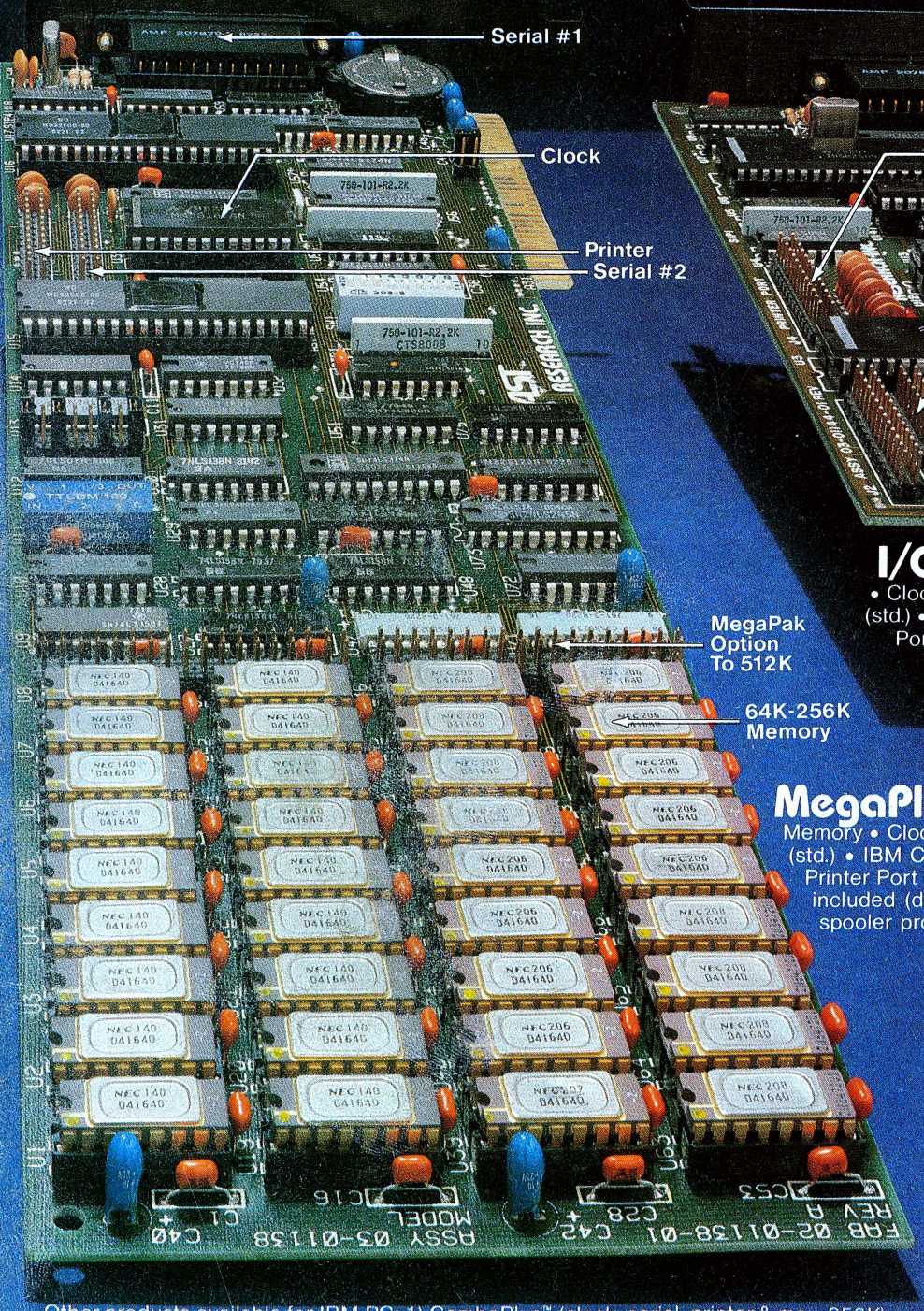

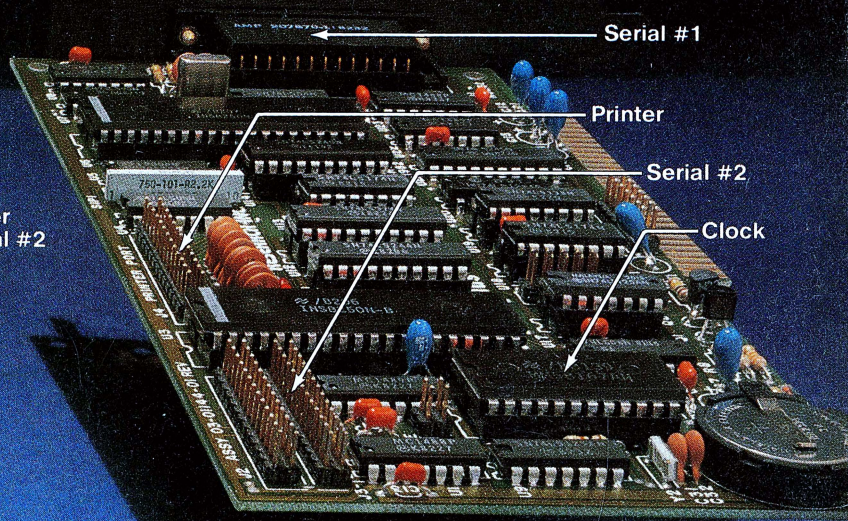

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